Controls will be implemented as part of any CERCLA response action at the Site, prohibiting use of groundwater at the Site. Therefore, while transport of COCs at the Site may occur by leaching from soil to groundwater, the Site data support that transport to potential receptors is extremely limited.

As is discussed previously in this RI Report, the New Miami well field is located to the west-northwest of the Site, while the Hamilton North Well Field is located south of the site. The GMR flows between the Hamilton North Well Field and the Site. Based on records that were available for the USGS study in 2005, the North Well Field was, at that time, used to augment production from the Hamilton South Well Field (located at a further distance from the Site), with the North Well Field operating intermittently and producing much less water for public consumption than the South Well Field.

KEMRON requested information from the City of Hamilton regarding certain current production, design and geologic records for the North Well Field. To date, no information has been received from the City of Hamilton in response, though KEMRON understands that the City is considering KEMRON's request. Without additional information regarding the Hamilton North Well Field, it is not possible to complete a meaningful hydrogeologic analysis of the potential interaction of the Site with this public water supply at this time.

The New Miami Well Field is located upgradient of the Site, with a single treatment plant producing water from three groundwater wells. Since regional groundwater flow is to the south, and Site groundwater flow has been demonstrated to be to the south or south-southwest (depending upon the depths of wells evaluated), the Site is not considered to pose a significant risk to the New Miami Well Field.

In the absence of detailed and current data and information regarding the Hamilton North Well Field, KEMRON has focused a conceptual fate and transport analysis based upon the available Site data and the well field data available in the 2005 USGS publication.

Analytical results from soil borings and monitoring wells on the southern parcel indicate that constituents of concern are concentrated within AOC 13. Monitoring wells in the southern portion of the Southern Parcel indicate that downgradient groundwater has not been impacted by the Site. Review of Site potentiometric surface maps (Figures 3.7.2-1 through 3.7.2-4), in conjunction with river gauging evaluations conducted during the Site RI, indicates that the shallow and intermediate aquifers are discharging to the GMR. Site geologic cross-sections (Figures 3.4.2-1 through 3.4.2-5) demonstrate that a substantial clay layer is consistently identified in the subsurface at the Site, providing a significant hydrogeologic barrier to migration of contaminants from the shallower, more contaminated units to the deeper sand and gravel. Figure 3.4.2-2 includes an interpretation of the geology from the Site to the Hamilton North Well Field, using both Site well/soil boring logs and geologic information included in USGS Scientific Investigations Report 2005-5013 (Sheets and Bossenbroek, 2005).

As discussed in Section 3.6, the results of the USGS study at the Hamilton North Well Field indicated the major influence to the aquifer is the water level of the Great Miami River. The study also conducted in-situ tests for hydraulic conductivity of the upper unconfined unit and lower semi-confined unit (separated by the discontinuous clay layer illustrated in Figure 3.4.2-2). The resulting values were 0.2 ft/d for the semi-confined unit and 200 ft/d for the unconfined unit (Sheets and Bossenbroeck, 2005). Streamflow gauging data collected between 1968 and 1997 by the USGS in Hamilton indicated periods of high discharge occur during the months of March

and April (approximately 6,000 cubic feet per second [mean monthly discharge]) and the lowest discharge periods were observed in September and October (Debrewer et.al., 2000).

The USGS data, when correlated with the Site geologic data, indicates that the producing interval of the northernmost production well at the Hamilton North Well Field (noted as PW on Figure 3.4.2-2) is in a portion of the Great Miami River Buried Valley Aquifer that is significantly deeper than detected Site contaminants. Further, the USGS study and the interpreted hydrogeology between the Hamilton North Well Field and the site indicates that the public water supply well at this location would not have a high probability of being in communication with the impacted portions of the Site. This is based on the anticipated production of water from sands immediately surrounding the public water supply well and waters produced via drawdown from the GMR. The presence of the significant clay layer, as interpreted based upon available data, indicates that the clay would likely provide a significant aquitard and would, at a minimum, impede, if not prevent, migration of contaminants from the Site to the well field.

In summary, Site data and publicly available data from the Hamilton North Well Field indicate transport of constituents in groundwater from the Site are anticipated to be inhibited significantly by the clay identified below the shallower, more significantly impacted groundwater. Site water level and relevant river gauging data also indicate that groundwater from the shallower Site sand and gravel discharge to the river. A review of site groundwater analytical data from wells MW-4M, MW-3D, MW-7M and MW-20M demonstrate an absence of significant detections of constituents of concern in the deeper sands being monitored by these wells (see Figure 3.4.2-2, Figure 4.29.1-1 and Figure 4.29.1-2).

Based on an evaluation of the above information and site data, combined with current limitations in available information and data from the Hamilton North Well Field, fate and transport modeling is not recommended for the site at this time. Should future groundwater monitoring data result in a significant change in the interpretation of the site conceptual hydrogeologic model as described in this section, such that the Hamilton North Well Field would be indicated to be at risk from Site COCs, the need for fate and transport modeling would be re-evaluated. Should additional information be made available from the City of Hamilton relative to historical, current and anticipated future pumping activities at the Hamilton North Well Field, as well as the other information requested by KEMRON, the information provided will be evaluated to determine the appropriateness of conducting fate and transport modeling for the Site. Until such time as this information becomes available, any attempts at fate and transport modeling are not expected to generate accurate results and predictive conclusions.

AK Steel anticipates that as the CERCLA process moves into the Feasibility Study and Record of Decision, remedial action(s) will be conducted to address and mitigate risk drivers at the site with consideration given to reasonably anticipated future land use. The implementation of the selected remedial alternative(s) for the Site will be designed to meet applicable or relevant and appropriate regulatory requirements. It is anticipated that actions taken to address the risk drivers in soil and groundwater at the Site will address any potential future risk to off-site receptors, including any potential threats to the North Hamilton Well Field.

# 6.0 Baseline Human Health Risk Assessment

The draft Baseline Human Health Risk Assessment (HHRA) was submitted to USEPA in September 2006. USEPA comments on the draft document were issued in August 2007. ENSR and EPA reviewed the comments in a September 2007 conference call, and written responses to comments were prepared in September 2007. However, EPA identified to KEMRON in May 2008 that the responses to comments were not received by USEPA or TetraTech (EPA oversight contractor) personnel. The responses to comments were re-issued by KEMRON on behalf of AK Steel in May 2008.

USEPA approved the responses with minor additional comments in a letter dated May 15, 2008. The ENSR HHRA team was retained by AK Steel, with the same lead ENSR human health risk assessor involved for consistency in this element of the project. ENSR revised the HHRA consistent with the final May 2008 responses to EPA comments, incorporating the 2008 Supplemental RI data as completed by KEMRON, and addressing EPA's final comments presented in May 15, 2008 US EPA correspondence. As the Supervising Contractor, KEMRON provided oversight and management regarding the HHRA revisions.

The revised HHRA was submitted concurrently with this RI Report in November 2008. This section of the RI Report summarizes the findings of the HHRA. The reader is referred to the full report for additional details.

The HHRA includes all Site data for all media sampled throughout all phases of the RI, including Site surface and subsurface soils, slag located on-site, on-site groundwater, a swale/intermittent stream in AOC 7, surface water from AOC 7, surface soil in the GMR riparian area (AOC 22) adjacent to the Site, and GMR sediment and surface water. The HHRA characterizes risks at the site within the CERCLA and NCP range of $1x10^{-6}$ to $1x10^{-4}$ for potential carcinogens and a target Hazard Index threshold of 1 for non-carcinogens that act upon the same target organ. While this risk range is addressed throughout the HHRA, CERCLA and the NCP do not mandate a CERCLA response action be taken when potential risk exceeds the lower ($1x10^{-6}$) threshold. As requested by USEPA, any COPC that the HHRA indicated exceeded the $1x10^{-6}$ risk level for a particular receptor was designated as a COC. The target risk levels used for the identification of COCs are based on USEPA direction for the Site. It should be noted that, USEPA provides the following guidance (USEPA, 1991a):

> "Where the cumulative carcinogenic site risk to an individual based on reasonable maximum exposure for both current and future land use is less than $10^{-4}$, and the non-carcinogenic hazard quotient is less than 1, action generally is not warranted unless there are adverse environmental impacts." and,
>
> "The upper boundary of the risk range is not a discrete line at $1 \times 10^{-4}$, although EPA generally uses $1 \times 10^{-4}$ in making risk management decisions. A specific risk estimate around $10^{-4}$ may be considered acceptable if justified based on site-specific conditions."

Therefore, while COCs have been identified using a $10^{-6}$ risk level, further risk management determinations will be made and remedial action is not anticipated to be warranted for all COCs that have a risk above the threshold value of $1x10^{-6}$. AK Steel recommends that a potential risk threshold of $1X10^{-4}$ be applied to the Site.

## 6.1 HHRA Conceptual Site Model

A conceptual site model (CSM) is presented in the HHRA, and included in Appendix G to this RI Report. For purposes of developing a better understanding of potential exposure pathways for human receptors, the primary sources of historical releases to the environment were depicted in the CSM, along with the primary release mechanisms, primary and secondary affected media, potential routes of exposure and potential current and future human receptors. For purposes of this CSM, the various potential source areas associated with the past operations at the Site were grouped into eight primary sources. The "Former Production Areas" source area includes a large number of sources.

The media of interest addressed within the HHRA are:

- Surface soil/slag (0-2 foot below grade)
- Subsurface soil/slag (2-10 feet below grade)
- Hydric soil in the Riparian Area (AOC 22)
- Surface water in the intermittent stream (AOC 7) and the Great Miami River
- Sediment in the intermittent stream (AOC 7) and the Great Miami River
- Groundwater (on-site and off-site)
- Ambient air (particulates, volatiles)

The CSM was used to develop the potential current and future exposure scenarios for evaluation in the HHRA. The exposure scenarios are fully defined in the exposure assessment. This includes developing both a Reasonable Maximum Exposure (RME) scenario to represent upper bound exposures and risks and a Central Tendency Exposure (CTE) scenario to represent more likely or average exposures and risks. RME assumptions were employed in the quantitative risk assessment. CTE assumptions were evaluated for select exposure pathways in the Uncertainty Analysis (Section 7.0 of the HHRA) based on whether potential Site risks were identified above acceptable risk targets (i.e., the upper end of USEPA's target cancer risk range of $1 \times 10^{-6}$ to $1 \times 10^{-4}$ and/or a non-cancer hazard index of 1 (on a target organ basis)).

Exposure scenarios were developed consistent with the CSM. The potential exposure pathways for human receptors at the Site are as follows:

- Ingestion, dermal contact, and inhalation of on-site surface soil and subsurface soil;
- Ingestion, dermal contact, and inhalation of hydric soil in the Riparian Area (AOC 22);
- Ingestion and dermal contact with sediment and dermal contact with surface water present in the intermittent stream (AOC 7) and the Great Miami River;
- Consumption of fish caught in the Great Miami River, including the portion of the river north of the Site where the former COG pipeline (AOC 19) runs underneath the river;
- Consumption of groundwater as drinking water, and dermal contact with tap water while bathing (for a residential receptor);

- Inhalation of volatiles (vapor intrusion to indoor air).

The future use of the Site will continue to be non-residential (i.e., commercial, industrial). It is anticipated that Institutional Controls will ensure that the future land use is restricted. While the reasonably anticipated future use under CERCLA excludes residential development, at the request of USEPA, a hypothetical future adult and child resident receptor who lives on-site was included in this baseline HHRA. The potential receptors and exposure pathways evaluated in the HHRA were consistent with those identified in the USEPA approved RI/FS Work Plan (ENSR, 2005).

## 6.2 HHRA Potential Receptors

Potential human receptors included in the HHRA are identified within the CSM, and include:

- Current and future trespasser, evaluated for potential exposure to COPCs in on-site surface soil via ingestion, dermal contact, and inhalation of particulates in outdoor air. The trespasser was also evaluated for potential exposure to surface and subsurface soil COPCs via inhalation of volatiles in outdoor air. The trespasser was also evaluated for potential exposure to COPCs in sediment and surface water in the Great Miami River and the intermittent stream (AOC 7) via ingestion and dermal contact with sediment and dermal contact with surface water.

- A current and future recreational angler was evaluated for potential exposure to COPCs in sediment and surface water in the Great Miami River via ingestion and dermal contact for sediment and dermal contact for surface water. The recreational angler was assumed to ingest fish caught in the river. The intermittent stream (AOC 7) does not support a fish population.

- A hypothetical future on-site resident (adult and child) was evaluated for potential exposure to COPCs in surface soil via incidental ingestion and dermal contact, and inhalation of particulates in outdoor air. The hypothetical future on-site resident was also evaluated for potential exposure to surface and subsurface soil COPCs via inhalation of volatiles in outdoor air. Additionally, the hypothetical future on-site resident was evaluated for ingestion of groundwater used as drinking water and dermal contact with tap water while bathing. Potential exposure to volatile groundwater COPCs via inhalation (vapor intrusion to indoor air) was also evaluated. Potential exposure via inhalation of volatiles released from groundwater for household tasks is discussed qualitatively in Section 6.3.3 of the HHRA.

- A current and future off-site resident (adult and child) was evaluated for potential exposure to COPCs in groundwater from the Hamilton North Well Field via ingestion of groundwater as drinking water and dermal contact with tap water while bathing.

- A future construction/utility worker was evaluated for potential exposure to constituents in surface and subsurface soil (ingestion, dermal contact, inhalation of particulates and volatiles). Construction/utility work is assumed to occur to a maximum depth of 10 feet bgs. Depth to groundwater at the Site is greater than 10 feet bgs in the shallow aquifer. Therefore, the construction/utility worker was not evaluated for exposure to COPCs in shallow groundwater. A screening-level analysis was performed to evaluate inhalation of VOCs that may volatilize from shallow groundwater and migrate up through the vadose zone into a trench for a construction/utility worker. The evaluation demonstrates that

predicted potential carcinogenic risks and noncarcinogenic hazard indices are negligible. Therefore, this pathway was not quantitatively evaluated in the HHRA.

- A future on-site commercial or industrial worker was evaluated for potential exposure to COPCs in surface soil on-site via ingestion, dermal contact, and inhalation of particulates in outdoor air. Inhalation of volatile surface and subsurface soil COPCs in outdoor air was also evaluated. A second scenario, not discussed in the work plan, in which it is assumed that subsurface soils are brought to the surface, is also evaluated. The on-site worker was also evaluated for hypothetical potential exposure to COPCs via ingestion of groundwater used as drinking water.

Exposure areas were identified based on historic Site use and review of the Site data. Three primary exposure areas were identified based on historic Site use to include the Northern Parcel (AOC 1, AOC 2, AOC 13 and AOC 21, AOC 19 and Block A), Southern Parcel (All of the Southern Parcel excluding AOC 13) and AOC 13, and the former COG pipeline.

The hypothetical residential receptor was not carried through the entire HHRA. Potentially unacceptable risks were identified under the residential scenario for all exposure areas for a number of COPCs. Based on the results of the hypothetical future on-site resident scenario risk assessment, it was concluded that institutional controls should be placed on the property such that future residential development and use of groundwater as drinking water are prohibited. Elimination of the hypothetical future residential receptor and suggestion of institutional controls for the site are consistent with USEPA's written directives regarding consideration of land use in the CERCLA process (USEPA, 1995). Specific evaluation of institutional controls will be conducted via the Site CERCLA FS.

## 6.3 Carcinogenic Risk Characterization Results

Summary of RME Results

Table 9-1 of the HHRA presents a summary of the results of the baseline HHRA for the Reasonable Maximum Exposure (RME) scenarios. Potential RME carcinogenic risks in excess of $10^{-6}$ were identified for all receptors and areas. Based on these results, Central Tendency Evaluation (CTE) analyses were run for all scenarios as part of the uncertainty evaluation. In addition, a background evaluation was performed for key constituents in soil (i.e., specific metals contributing most to total risk and potentially carcinogenic PAH).

After accounting for consistency with background, the exposure areas and potentially carcinogenic COCs in soil based on the results of the RME analysis where a potential risk exceeds the most conservative risk threshold of $1x10^{-6}$ are as follows:

- AOC 1 – benzene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and PCBs
- AOC 2 - PCBs
- AOC 18 and 21 – PCBs
- Block A – benzene
- Southern Parcel – benzo(a)anthracene, benzo(a)pyrene, benzo(b)flouranthene, dibenzo(a.h)anthracene, and indeno(1,2,3-cd)pyrene

- AOC 13 – benzene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)flouranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and PCBs

Benzo(a)pyrene was identified as a potential COC in AOC 7 (intermittent stream) sediment, based on a potential direct contact risk to a trespasser of $3 \times 10^{-6}$, which falls at the low end of the target risk range. AOC 7 is principally a storm water drainage ditch and is dry much of the year. As such, the substrate may more accurately be considered hydric soil than sediment. Due to the limited number of AOC 7 "sediment" samples, a quantitative background evaluation could not be performed. However, as discussed in the Uncertainty Analysis, a qualitative comparison of potentially carcinogenic PAH compounds detected in AOC 7 and in background surface soil samples indicates that the levels of carcinogenic PAH detected in AOC 7 substrate are consistent with typical background PAH concentrations in surface soil impacted by historical anthropogenic activities, including the nearby railroad.

Based on qualitative evaluations of PAH, PCBs, and mercury in Great Miami River sediment and surface water, it is concluded that the presence of these compounds in the Great Miami River is attributable to background conditions and upstream sources.

Based on the results of the RME analysis of the hypothetical future on-site worker's use of on-site groundwater as drinking water, there are a number of wells with COCs posing risks in excess of $10^{-6}$. As previously stated, a restriction against groundwater use on site is anticipated for the Site as part of a CERCLA remedy. Therefore, while potential groundwater COCs are identified for completeness, remedial actions may not be warranted because an institutional control will prevent the exposure, thereby eliminating any potentially unacceptable risks. Potential COCs were identified in the following wells:

- Northern Parcel – MW-17S (arsenic only, at a concentration below the federal MCL)
- Southern Parcel – MW-1S, MW-2S, MW-3D, MW-3S, MW-4M, MW-4S, MW-7M, MW-19S, MW-23S (arsenic in all but one well, benzo(a)pyrene in two wells, all at concentrations below the respective MCLs)
- AOC 13 – MW-8M, MW-8S, MW-9M, MW-9S, MW-20M, MW-20S, MW-21S, MW-27M, MW-27S, MW-28S, MW-29S, MW-31S

Primary risk drivers in groundwater include arsenic, benzene, and potentially carcinogenic PAH. The majority of wells with groundwater COCs are located within AOC 13. In fact, only arsenic and benzo(a)pyrene are identified as groundwater COCs in AOC 1 and the Southern Parcel, and groundwater EPCs used in the HHRA for these two COCs and areas were below their respective MCLs. Arsenic was consistent with background in soils of every AOC of the site, however was conservatively considered a COC in groundwater for the Southern Parcel, AOC13, and off-site groundwater. The soil arsenic data support the conclusion that the source of arsenic to groundwater is background concentrations in soil and would not be regulated under CERCLA.

Based on the results of the RME analysis of the off-site resident at the Hamilton North well field, four potentially carcinogenic COCs were identified – arsenic, benzene, benzo(a)pyrene, and BEHP. Based on a review of the intermediate and deep groundwater data used in this scenario, potentially unacceptable risk to the off-site resident receptor is limited to wells located within AOC 13. The estimated risk is also overestimated, because it assumes that there is no attenuation or degradation of chemicals between the Site and the Hamilton North well field. This is clearly an overly conservative assumption, especially for organics like benzene which are known to

biodegrade in the environment, arsenic which is not a COC in site soils, and for PAH compounds like benzo(a)pyrene, which is consistent with background across much of the site and adsorbs tightly to soil particles such that appreciable transport in groundwater is not considered likely.

The total potential carcinogenic risk for the hypothetical future on-site resident is greater than the most conservative end of the acceptable risk range of $1 \times 10^{-6}$ to $1 \times 10^{-4}$ in all areas evaluated for the Site. Both soil and groundwater pathways contribute significantly to risk exceedances. Primary risk drivers in soil include PCBs, potentially carcinogenic PAHs, and arsenic. Note that based on the background evaluation, levels of arsenic and potentially carcinogenic PAH in surface soil in all AOCs, including AOC 19 (the off-site portion of the former COG pipeline), were found to be consistent with background. Primary risk drivers in groundwater include potentially carcinogenic PAHs, benzene and arsenic. RME risk estimates that include background levels of highly toxic, yet naturally or otherwise identified as occurring regionally/at background concentrations, including compounds such as arsenic and benzo(a)pyrene at this Site, do not represent risk estimates for use in determining appropriate action at a site regulated under CERCLA.

Summary of CTE Results

HHRA Table 9-2 presents the results of the baseline HHRA for the CTE scenarios. Differences in risk and hazard estimates between the RME and CTE estimates are the result of reduced exposure estimates in select CTE exposure parameters (i.e., reduced exposure frequency or ingestion rate). No reduction in EPCs was considered for the CTE analysis. The CTE and RME estimates are both developed using 95%UCL estimates in soil and maximum concentrations detected in groundwater. CTE exposure parameters are presented in HHRA Tables 5-3 through 5-8. While potential CTE carcinogenic risks in excess of $10^{-6}$ were identified for all receptors and most areas, the list of carcinogenic COCs is shorter than for the RME analysis. For example, based on the CTE analysis, PCBs are no longer COCs in AOC 2 or AOC 18/21, lead is no longer a COC in AOC 1, and manganese is no longer a COC in Block A. The list of groundwater COCs in AOC 13 is also considerably shorter. In addition, based on the results of the CTE analysis, AOC 7 no longer poses an unacceptable risk.

## 6.4 Noncarcinogenic Risk Characterization

Summary of RME Results

HHRA Table 9-1 presents the results of the baseline HHRA for the RME scenarios. Potential RME noncarcinogenic HI in excess of 1 on a target organ basis were identified for all receptors and areas. Based on these results, CTE analyses were run for all scenarios as part of the uncertainty evaluation. As shown in HHRA Table 9-3 through 9-5, after accounting for consistency with background, areas and noncarcinogenic COCs in soil based on the results of the RME analytes are:

- AOC 1 – PCBs and naphthalene
- Block A – manganese
- AOC 13 – naphthalene

With regard to naphthalene, the models used by USEPA to estimate volatilization from soil to ambient air are known to be conservative (e.g., assume infinite source), as discussed in USEPA guidance (2002b). Thus, the naphthalene potential risk presented in the HHRA for the pathway of

volatilization to air is extremely conservative. It is very likely that use of more refined volatilization modeling methods, such as EMSOFT, would result in acceptable ambient air concentrations of naphthalene and the resulting hazard indices for naphthalene in AOC 1 and AOC 13 would drop to below 1.

The only noncarcinogenic COC for sediment based on the results of the RME analysis is PCBs (potential bioaccumulation into fish tissue). PCBs is a sediment COC in both the reach of the Great Miami River adjacent to the Site and the reach adjacent to AOC 19 (where the former COG pipeline passed beneath the river). Of significant note is that upgradient concentrations of PCBs in sediment posed the highest fish consumption risk of the three reaches evaluated in the baseline HHRA. This fact indicates that the Site is not impacting PCB concentrations such that a CERCLA response to the PCB sediment concentrations in the river sediment would be appropriate.

The only noncarcinogenic COC for surface water based on the results of the RME analysis is mercury (potential bioaccumulation into fish tissue). Like PCBs, mercury is a surface water COC in both the reach of the Great Miami River adjacent to the Site and the reach adjacent to AOC 19. The absence of a Site-related impact to mercury potential risk indicates that a CERCLA response would not be appropriate.

As discussed in the Uncertainty Analysis of the HHRA (Section 7.0), there is considerable conservatism in the models used to estimate fish tissue concentrations of bioaccumulatable compounds like PCBs and mercury due to uptake from sediment and surface water. The overconservatism of the methods was discussed and supported by actual measured concentrations in Great Miami River surface water (for mercury) and fish tissue (for PCBs), as well as the upgradient sediment data set for PCBs. In summary, the HHRA and data collected via the RI indicate that both PCBs in river sediment and mercury in river surface water are related to background conditions in the Great Miami River and not the Site.

Based on the results of the RME analysis of the hypothetical future on-site worker's use of on-site groundwater as drinking water, there are a number of wells with COCs with hazard indices in excess of 1. As previously stated, it is anticipated that a restriction against groundwater use on site will be obtained. Therefore, while potential groundwater COCs are identified for completeness, remedial actions may not be warranted because an institutional control will prevent the exposure thereby eliminating any potentially unacceptable risks. Potential noncarcinogenic COCs were identified only in AOC 13 wells and include arsenic, cyanide, dibenzofuran, naphthalene compounds, and 2,4-dimethylphenol.

Based on the results of the RME analysis of the off-site resident at the Hamilton North well field, four noncarcinogenic COCs were identified – cyanide, naphthalene, 2-methylnapthalene, and 1-methylnaphthalene. Based on a review of the intermediate and deep groundwater data used in this scenario, potentially unacceptable risk to the off-site resident receptor is limited to wells located within AOC 13. The estimated risk is also overestimated, because it assumes that there is no attenuation or degradation of chemicals between the Site and the Hamilton North well field. This is clearly an overly conservative assumption, especially for PAH compounds like the methylnaphthalenes, which tend to adsorb tightly to soil particles and do not move appreciably in groundwater.

The total potential noncarcinogenic risk for the hypothetical future on-site resident exceeds the target HI of 1 in all areas evaluated for the Site. Both soil and groundwater pathways contribute significantly to risk exceedances. Primary risk drivers in soil include PCBs, PAHs, arsenic, iron, and manganese. Arsenic and potentially carcinogenic PAH in surface soil in all AOCs are

consistent with background, and iron and manganese in the surface soil of some AOCs (including AOC 19) are consistent with background. Primary risk drivers in groundwater include PAHs, benzene, arsenic, iron, manganese, toluene, cyanide, and vanadium.

In summary, potentially unacceptable risks were identified under the hypothetical future on-site residential scenario for all exposure areas for a number of COPCs. It is concluded that institutional controls should be placed on the property such that future residential development and use of groundwater as drinking water are prohibited.

Summary of CTE Results

HHRA Table 9-2 presents the results for the CTE scenarios. Because of the limited number of noncarcinogenic COCs and areas identified in the RME risk characterization, the impact of the CTE analysis on eliminating additional COCs is limited. Manganese in Block A soil and mercury in river surface water at AOC19 are eliminated as potential noncarcinogenic COCs. Receptor hazard indices for AOC 2, AOC 18/21, AOC 19, Block A, and Southern Parcel (excluding AOC 13) are all below 1. Only PCBs and naphthalene in AOC 1 and AOC 13 still have hazard indices greater than 1 and are thus identified as COCs based on the CTE analyses. Based on the results of the CTE analysis, the list of wells and groundwater COCs in AOC 13 is also shorter.

## 6.5 HHRA-Derived Final Site COCs

Tables 9-3 through 9-5 of the HHRA present a summary of the COCs for the ARMCO Hamilton Plant Site after consideration of consistency with background for soil. This table illustrates that potential COCs were identified in six of the soil exposure areas evaluated in the baseline HHRA. AOC 19 (off-site area near former COG pipeline) and AOC 22 (Riparian Area) had COCs identified in this area after accounting for the background evaluation. In four of the six areas (AOC 2, AOC 18/21, Block A, and Southern Parcel), the number of COCs is limited to one to three compounds, and several of these would not be identified as COCs using results of the CTE analyses. In AOC 1 and AOC 13, soil COCs are limited to benzene, several potentially carcinogenic PAH compounds (in subsurface soil only), naphthalene, and PCBs.

For sediment at the Great Miami River (reach adjacent to the Site), COCs are limited to potentially carcinogenic PAH (direct contact exposure) and PCBs (bioaccumulation to fish tissue). Two potentially carcinogenic PAH are also identified as COCs in AOC 7 sediment (direct contact exposure), however, these PAH would not be identified as COCs using results of the CTE analysis for AOC 7. PCBs are also identified as a COC for sediment based on bioaccumulation to fish tissue in the AOC 19 reach. However, upgradient sediment PCBs modeled to fish tissue was also shown to pose unacceptable risk to the recreational angler. These results, coupled with awareness of the overconservatism in the model used to estimate bioaccumulation in the fish, suggest that the presence of PCBs in river sediment is related to overall river conditions in the Great Miami River and not the Site.

Mercury is the only COC in Great Miami River surface water based on potential bioaccumulation to fish tissue for the recreational angler. As with PCBs, measurement data for mercury in the river, as well as awareness of the overconservatism of the model as applied to total mercury results, suggest that the presence of mercury in river surface water is related to overall river conditions in the Great Miami River and not the Site.

For groundwater, there are a number of wells with COCs, however, they are largely limited to AOC 13. Further the identification of groundwater COCs based on the presumption of use of on-site groundwater as drinking water is overly conservative given groundwater is not currently used

as an on-site drinking water source and institutional controls will be proposed to prohibit use of groundwater at the Site as a drinking water source. Thus, the drinking water pathway evaluated in this risk assessment is truly a hypothetical one.

## 6.6 HHRA-Derived Remedial Goal Options

Remedial Goal Options (RGOs) were developed for constituents identified as COCs in the HHRA, based on the three potential target risks ($1x10^{-4}$, $1x10^{-5}$ and $1x10^{-6}$) in the CERCLA risk range for carcinogens. The RGOs for all COPCs, beyond the final COC list, are presented in text and tables of Section 8 of the HHRA.

The RGOs for a current on-site worker, based upon the reasonably anticipated future use of the property continuing as a closed industrial site, and the COCs identified for the Site above each RGO, are presented in Figures 6.6.1-1 through 6.6.1-3. These figures illustrate the limited extent of COCs in site surface soils above the RGOs established via the HHRA. Naphthalene, benzene and PCBs are the only COCs that exist in site soil above RGOs developed using a current on-site worker exposure (e.g. surface soils only) for the site. One PCB detection, one benzene detection and three naphthalene detections exceed the RGOs developed using $10^{-4}$ as a target risk (Figure 6.6.1-1) and include AOC 1, and AOC 13. Using $10^{-5}$ as a target risk, the surface soil detections above RGOs are reduced to 2 PCB detections, 4 benzene detections and three naphthalene detections (Figure 6.6.1-2) and include AOC1, AOC 13 and Block A. Nine PCB detections, six benzene detections and three naphthalene detections exceed the$10^{-6}$ RGOs (Figure 6.6.1-3). The sample locations include AOC 1, AOC 2, AOC 13, and Block A. A number of the benzene detections noted (4 of 6) are J flag results.

It is of note that the tarry material visually observed within AOC 22 was not included in the Baseline HHRA, but only soil concentrations of COPCs were evaluated within the context of the HHRA in conformance with the established scope for the risk assessment. Further, inclusion of the tarry material in the scope of the HHRA was not considered appropriate based on the assumption that, if the RI determined that the tar material was likely to be from the Site, this material was anticipated to be addressed in the Site FS. The HHRA demonstrates that the tarry material observed at the surface in AOC 22 has not significantly leached to or otherwise significantly impacted the surface soils within AOC 22, since the soil samples have been determined to not exceed background concentrations and not to pose a potential unacceptable risk based upon standard, conservative risk methodologies employed in the HHRA. The tarry material is discussed further in Section 4.30 and Section 8 of this RI Report, and is recommended for evaluation of remedial alternatives within the context of the Site FS. Assuming that the tarry material is addressed through a CERCLA response at the Site such that agreed upon Remedial Action Objectives and Remedial Goals are achieved at the tarry material locations, no unacceptable risk will remain as demonstrated through the HHRA evaluation of soils within AOC 22 and completion of appropriate documentation of the tarry material response action.

The HHRA concluded that off-site groundwater risk is based upon COCs within AOC 13. Further, the off-site groundwater potential risk identified within the HHRA does not consider that the AOC 13 wells with elevated detections of COCs are impeded by the substantial clay layer at the site (see Figures 3.4.2-2 and 3.4.2-3), and therefore is very conservative. As noted in Section 5 of this RI Report, fate and transport modeling has not been conducted for the site and may not be necessary, based on the known site hydrogeologic conditions and anticipated action through the CERCLA process to address AOC 13 COCs that drive potential risk for the off-site groundwater use pathway.

## 6.7 Final Conclusions from HHRA Findings

Consistent with the preamble to the NCP, AK Steel notes that the assumption of residential land use is not a requirement of the CERCLA program. AK Steel notes that in the preamble to the NCP, USEPA noted that "An assumption of future residential land use may not be justifiable if the probability that the site will support residential use in the future is small." The Site is anticipated to remain an industrial site, and further evaluation of residential use is not appropriate. Therefore, through the FS, AK Steel anticipates that use of institutional controls as limited action alternatives will be appropriate.

Very low frequency of detections of COCs are noted in AOC 1 after consideration of background concentrations.

AOC 2 merits further evaluation via the Site FS based the waste remaining in place within the closed landfill. However, this AOC does not pose unacceptable risk to human health outside of the landfill boundaries at any of the risk range evaluations ($10^{-4}$ through $10^{-6}$). COCs were consistent with background and/or posed no significant risk when evaluated under the CTE. Potential exposure in this AOC is more likely representative of the CTE analysis as the landfill provides limited access as a result of AOC 2 perimeter fencing and there is no reason for on-site personnel or trespassers to spend time on or have interest in this portion of the property for more than 26 days a year (CTE trespass exposure frequency) for 10 years (RME and CTE trespass exposure duration).

AOC 13 groundwater and soil will need to be evaluated within the Site FS, to assure identification and analysis of remedial alternatives that will address soil and groundwater contamination issues. Addressing the AOC 13 COCs via a CERCLA response action is anticipated to result in mitigation of any potentially unacceptable risk above the anticipated applicable threshold of $1X10^{-4}$.

PCBs and mercury within the GMR, while presenting potential risks above the CERCLA risk range for an angler, do not appear to be associated with the Site. Potential risks calculated for angler exposure to PCBs at Upstream locations are higher than those adjacent to and downstream of the site. PCBs and mercury are limited in their contribution to on-site risk and hazard estimates. The concentrations in on-site soils do not support a connection or contribution to the GMR sediment. The presence of PCBs in upstream sediment at levels that are in the range of those concentrations adjacent to and downstream of the site suggests that PCBs adjacent to the site are representative of background conditions in the GMR as a result of upstream sources. In addition, the assumptions included in the angler fish ingestion exposure pathway and bioaccumulation model have significant potential to overestimate exposure estimates. As presented within the Baseline HHRA, evaluation of river sediment PAH concentrations in conjunction with upstream concentrations indicates that PAH sediment concentrations are consistent with and related to upstream conditions and not solely attributable to the Site. Therefore, CERCLA action in response to these COCs in the GMR is not appropriate.

AOC 7 does not pose unacceptable risk to human health based upon the CTE analysis. Further, as noted in the AOC 7 discussion of Section 4 of this RI Report, the highest PAH concentrations at AOC 7 are downgradient of the railroad track. PAH concentrations in AOC 7 samples adjacent to the closed landfill in AOC 2 do not have significant PAH detections. The PAH detections downstream of the railroad may be more reflective of railroad contributions to this AOC than Site conditions.

Table 9-5 of the Baseline HHRA summarizes the COCs at the $1x10^{-4}$ risk level for all AOCs. Table 6.7-1 to this RI Report summarizes the conclusions presented in Tables 9-3 through 9-5 of

the HHRA. As presented in that table, after CTE analysis and consideration of background soil conditions and Great Miami River upstream sediment and surface water sample results, the calculated potential risk that exceeds $1x10^{-4}$ at the site is limited to:

- Naphthalene in AOC 1 soil (based upon a single sample location);
- Naphthalene in AOC 13 soil;
- SVOCs, benzene, toluene, and cyanide in AOC 13 groundwater.

The off-site groundwater potential COCs are limited to a subset of SVOCs, potentially arsenic (without consideration of arsenic, due to the off-site location), cyanide, and naphthalene. The potential off-site groundwater calculated risk is based upon concentrations of these parameters in groundwater within AOC 13 monitoring wells.

# 7.0 Baseline Ecological Risk Assessment

## 7.1 Screening Level Ecological Risk Assessment

A draft of the Screening Level Ecological Risk Assessment (SLERA) for the Site was submitted to USEPA on July 14, 2006. OEPA provided the lead review of the SLERA. A revised SLERA was submitted, and ultimately, based upon OEPA comments and responses, a Final SLERA was submitted on March 18, 2008. Ohio EPA approved the Final SLERA in correspondence dated Mary 05, 2008. USEPA provided final written approval of the SLERA in a July 08, 2008 letter.

The Final SLERA addressed the GMR and the upland portion of the Site (which includes all areas of concern (AOCs) and former production areas (i.e., Block areas) except AOC 22) and was based on data collected during the 2005 to 2006 Phase 1 RI field program.

The Draft SLERA was submitted to the U.S. EPA in July 2006 (ENSR, 2006a). The Final SLERA report was prepared in response to comments from U.S. EPA, which were provided to AK Steel in November 2006. The Final SLERA also reflected numerous communications between AK Steel, U.S. EPA, and OEPA regarding the agency comments, AK Steel response to comments, and the revisions of the SLERA.

Several meetings and telephone conferences were held between U.S. EPA, OEPA, AK Steel, and AK Steel's contractor (ENSR Corporation [ENSR]) following AK Steel's submittal of interim comment responses on December 21, 2006. On June 1, 2007 a Site inspection attended by representatives of OEPA, AK Steel and ENSR was conducted in order to introduce the OEPA ecological risk assessor to the Site, and for members of the project team to help determine the pathway(s) forward for completion of ERA activities at the Site. Discussions during and subsequent to the site visit resulted in the following conceptual agreement between AK Steel and the agencies on how to finalize the SLERA and the RI Report, including:

1. The results of the SLERA indicated that additional Baseline ERA (BERA) activities were required under the RI program to better understand whether or not a potential for ecological risk exists in the Great Miami River adjacent to the Site;

2. The results of the SLERA indicated that additional investigation of the riparian floodplain located between the Site and the adjacent river was warranted based on the observation of tar-like material in portions of the floodplain adjacent to the Site; and

3. The results of the SLERA indicated that no additional ecological risk evaluation of the terrestrial AOCs, Block areas or AOC 7 were warranted, and that a finding of no significant risk could be reached for these portions of the Site.

In order to further evaluate ecological conditions within the Great Miami River and its floodplain, additional investigations were conducted for the Site, including additional sediment sampling, and a fish and benthic study. A work plan for a supplemental Great Miami River field effort was provided to the USEPA and OEPA in August 2007. Substantial field work on the river commenced in the fall of 2007. This field effort included sediment sampling, as well as biological surveys of the benthic invertebrate and fin fish communities (conducted in accordance with OEPA biocriteria guidance; OEPA, 1987a; 1987b; 1989a; 1989b). The results of the 2007 biological sampling efforts are included in the Site BERA (KEMRON, 2008). Investigation regarding the nature and extent, and potential risks, associated with the tar-like material in the riparian area

(AOC 22) was included in Supplemental Site Investigation activities conducted in 2008; the results of the AOC-22 investigation are included in Section 4.0 of this RI.

The Final SLERA presented a screening of sediment, surface water, and surface soil data collected during the 2005 to 2006 field effort. It also presented the SLERA problem formulation, which includes an evaluation of potential exposure pathways, a conceptual site model, and the SLERA measurement and assessment endpoints. The SLERA was designed to serve as Steps 1 and 2 of the U.S. EPA eight-step process for ecological risk assessments at Superfund sites (U.S. EPA, 1997). In addition, the SLERA served to present the framework for Step 3 (Problem Formulation Statement (PFS) of the ERA process.

The results of the SLERA indicated that:

- The six terrestrial exposure areas (AOC 1, AOC 2, AOC 18 and AOC 21, AOC 19, Block A and Southern Parcel) and the AOC 7 dry bed intermittent stream channel are sufficiently characterized by the SLERA, and a conclusion of no significant ecological risk was the recommended outcome for these areas.
- Elevated levels of constituents may be present in the sediment in the Great Miami River adjacent to the Site. Additional BERA activities were recommended for certain Screening Level Contaminants of Potential Concern (SLCOPCs) in this portion of the Site.
- Based on the presence of tar like material in small finite portions of the floodplain of the Great Miami River (i.e., AOC 22), investigation of the riparian floodplain adjacent to the river was also recommended. Sampling and laboratory analysis of AOC-22 were included in the Supplemental Remedial Investigation Work Plan as finalized by KEMRON, and included as described in the April 28, 2008 document approved by USEPA in its July 08, 2008 correspondence. The results of the AOC-22 investigation are incorporated into this RI Report and the BERA.

## 7.2 Additional GMR Investigation

Based on the EPA-approved Ecological Risk Assessment Supplemental Work Plan, Revision 1, August 2007 (ENSR, 2007), additional sediment sampling was conducted in the GMR. Also, a *Fish and Benthic Study of the Great Miami River* was prepared by KEMRON and subcontractor EA Engineering, Science and Technology. Together with existing OEPA fish tissue studies and previous GMR sediment sampling and analysis, these new data provided significant insight into the impacts of the Site on the GMR. The Fish and Benthic Study (also identified in some project records as the biocriteria report) concluded that, based on the fish and macroinvertebrate results, no further investigation of the Great Miami River is warranted to evaluate ecological impact to the river from the site under CERCLA and the NCP. OEPA concurred with this report in correspondence dated May 30, 2008; USEPA's approval of the report was dated July 08, 2008.

The results of the 2007 sediment sampling and analysis, and the Fish and Benthic Study were both integrated into the Site BERA, which is being submitted concurrently with this RI Report.

## 7.3 Baseline Ecological Risk Assessment

Based on the findings of the SLERA and the Fish and Benthic Study, a BERA was prepared for the Site. OEPA and USEPA indicated during an April 2008 project meeting that, in accordance with OEPA Ecological Risk Assessment guidance, a Risk Assessment Assumptions Document (RAAD) needed to be prepared and submitted in advance of the BERA. AK Steel and KEMRON agreed that a RAAD would be prepared; however, it was noted that the RAAD preparation would occur simultaneously with data collection under the final Supplemental Remedial Investigation

Work Plan. This concurrent preparation of the document during field activities would prohibit inclusion of the AOC 22 data within the RAAD. Further, while previous discussions of ecological risk assessment had indicated that a SLERA would be separately prepared for AOC 22, it was agreed that AOC 22 would occur within the RAAD.

A draft RAAD was prepared and submitted to EPA and OEPA on June 25, 2008. OEPA provided comments on the draft document on July 09, 2008. After discussion of the comments between KEMRON and the lead OEPA reviewer, a revised RAAD was submitted to EPA and OEPA as a Draft Final document on August 04, 2008. The OEPA submitted comments on the Draft Final document on 08/12/08. These comments were discussed in a project meeting on August 21, 2008, with USEPA, OEPA, AK Steel and KEMRON participants. Minutes of that meeting documented the resolution of the comments, and a USEPA decision that additional revision of the RAAD was not necessary. KEMRON agreed to proceed directly to development of the BERA, which would include all AOC-22 data, as well as OEPA fish tissue data, Site GMR sediment, benthic organism and fish study data from the Site RI field activities to date, and collection and analysis of at least two (2) soil samples for site-specific pH measurements for the BERA. USEPA and OEPA agreed that moving forward with the information presented in the Draft Final RAAD, and in conformance with OEPA guidance for ecological risk assessment (OEPA, April 2008), provided an acceptable means of completing the ecological risk assessment of the Site.

Based upon this agreement, KEMRON proceeded with development of the Site BERA in accordance with applicable guidance and the specifications of the Draft Final RAAD. It is of note that no known rare, endangered, or threatened species or rare habitats exist at the Site. The habitat of the Site and AOC 22 are considered poor due to past and current human activity, steep terrain and presence of debris in the riparian area.

As documented in the BERA (KEMRON, 2008), submitted in November 2008 to USEPA and OEPA for review and comment, the following conclusions have been reached regarding the Site's ecological risk:

- The Great Miami River is an industrialized River that has historically received and continues to receive point source discharges of industrial and municipal wastewater as well as non-point sources such as stormwater runoff. The accumulation of chemical pollutants such as PAHs, metals and PCBs in the sediments of rivers flowing through populated and industrialized areas is well documented. The Great Miami River is an example of such a river. Select metals, PAHs, and PCBs are present throughout the river (including Upstream of the Site) at concentrations above ecologically based low effect values. Levels of barium, chromium, copper, iron, lead, mercury, nickel, and zinc in the Upstream dataset exceed SRVs. SEM, AVS, and TOC data, however, indicate that the divalent metals within the Adjacent dataset and within most of the Upstream dataset are not likely to be bioavailable.

- Results of additional sediment sampling in the GMR in 2007 resulted in conclusion that there were impacted sediments upstream as well as adjacent to and downstream of the site. Sediment samples located to evaluate the potential for AOC 7 surface water and AOC 13 groundwater to discharge into the Great Miami River indicate that COPCs associated with these AOCs are not elevated within the river sediments in these areas.

- Sediment samples located in the vicinity of the tar-like materials in the floodplain (AOC22) do not contain significantly elevated levels of PAHs indicating that the tar-like material is not significantly impacting the river.

- The Site sediment sampling effort achieved confirmation that the GMR is a historically and currently industrialized river and chemical impacts in sediment exist.

- USEPA, OEPA and AK Steel agreed that direct measurement of endemic populations was the most direct approach to quantifying the potential ecological risk associated with sediments of the GMR upstream, adjacent and downstream of the site. The direct measurement of endemic populations in the river and the quantification of community health via the development of Community index scores, QHEI scores, and applicable ecoregion biocriteria values for the GMR upstream, adjacent and downstream of the site was conducted in 2007. It was determined that the AK Steel Hamilton Site appears to have little or no impact on the aquatic community in adjacent portions of the GMR based upon mean IBI, IWBmod, ICI and median QCTV scores among all potential impact locations which attained or suggested attainment of the established biocriteria. Adjacent and downstream index scores were generally similar to the upstream reference site.

- In addition, based on mean IBI and IWBmod scores and actual ICI scores, the fish and benthic communities at two of the four potential impact locations (GMRF25 and GMRF20L) met the narrative classification for very good (OEPA 2006b) and met all exceptional warmwater habitat (EWH) biocriteria. Per OEPA guidance, if the results of these indices indicates that performance expectations for the near-Site reaches of the river (as outlined in OEPA guidance and administrative code (OAC 37456-1-07, Table 7-17)) are met (*i.e.*, full attainment of a designated use, no substantial difference from upstream reference conditions), then no additional ecological risk analysis is warranted in the GMR.

- The only PBTs in AOC 22 soils and GMR sediment above background are mercury and PCBs. PCBs have been detected to a limited extent in site soils, a greater extent in GMR sediments (including upstream) and below ESVs in AOC 22 (riparian floodplain) surface soils. The low effect screening value for Total PCBs is exceeded in samples collected throughout the Great Miami River, including Upstream of the Site. On-site mercury and PCB levels were not determined to be a potentially significant ecological risk as a result of exposure to terrestrial on-site surface soils in the SLERA (ENSR, 2008). PCBs in the upstream GMR sediments have been shown to exist at levels above that measured in the River sediment adjacent to the site. Upstream sources of mercury and PCBs in GMR sediment have the potential to redistribute and deposit along the floodplain during storm events. The PCB concentrations measured in AOC 22 surface soils did not exceed the site ESV for PCBs and the sample locations for mercury and PCBs were along the floodplain that is frequently influenced by rises in water levels of the River. Floodplains are a known deposition area for sediments that are disturbed and redistributed during a storm event.

- Based upon the ecological data collected, PBTs are not considered a significant threat in the GMR or AOC22 as a result of site activities or releases to the River. A food-web analysis of PBTs (i.e., PCBs) was not considered warranted based upon: 1) the presence of upstream sources of PBTs as identified in upstream sediment samples, 2) a limited

presence of PBTs in sediment samples adjacent to the site or potentially site-related, 3) the limited presence of PBTs in site soils adjacent to or near the River (AOC 22), 4) low quality ecological habitat in AOC 22, and 4) the integrity of the benthic biological community in the GMR. The on-site soils do not present a mercury or PCB ecological risk and population level reproductive effects were not observed in the biological community assessment of the GMR (Appendix B). PCBs detected below the ESV and infrequent detections of mercury in AOC22 (floodplain) soils in between the site and the GMR are not considered site-related or significant.

- Soils of AOC 22 reveal the presence of similar compounds (low levels of inorganics, PAHs and PCBs) found in GMR sediments. It is not known if the compounds are a result of historical site release, background conditions, or deposition during a high water event in the GMR. The concentrations present are low, often at low frequency and the compounds (aside from mercury and PCBs addressed above) are not considered bioaccumulative or of significant threat to the GMR food web. The presence of low levels of COPCs along the river may represent background conditions of the river system and be the result of sediment redistribution in the river during storm events.

- The presence of organic and inorganic COPCs above probable effect screening values in GMR sediment resulted in a biocriteria survey that was conducted to evaluate the potential impacts that these stressors might be having on the macroinvertebrate and finfish community. The community specific data, index scores, associated Qualitative Habitat Evaluation Index (QHEI) results, and other habitat observations indicate that the former ARMCO Hamilton plant site has not adversely affected the biological communities in adjacent and downstream portions of the Great Miami River.

- No further assessment of sediment or riparian soil data in or near the GMR is anticipated as a result of the available data and a conclusion of "no effect" that resulted from the quantitative evaluation of sediment dwelling organisms (macro invertebrates) and fish in the GMR (KEMRON and EA Engineering, 2008). OEPA review of the Work Plan for this effort resulted in approval for AK Steel to "consider a "no effects" survey result as an off-ramp to further investigation of the Great Miami River for this site" (OEPA, 2007).

- Based on the body of data presented in the Baseline Ecological Risk Assessment, including, but not limited to, the absence of threatened and endangered species at the Site; the documented absence of impact to the river biota and achievement of exceptional warmwater habitat biocriteria in the river; documented upstream sediment concentrations of COCs; absence of significant or high quality ecological habitat within the riparian area; and, absence of significant PBT detections in the study area, no significant ecological risk is present to warrant additional evaluation or action at the Site.

The BERA concluded that no further ecological investigation of or response action for the AK Steel Former ARMCO Hamilton Plant facility or the Great Miami River is warranted for the Site under CERCLA and the NCP.

# 8.0 Summary and Conclusions

This section summarizes the results of the remedial investigation activities conducted to date and provides conclusions resulting from completion of the Site RI.

The RI was conducted in accordance with the SOW established in the April 2002 AOC, and USEPA *Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (October 1988), as well as USEPA approved site specific plans (e.g., Field Sampling Plan, Supplemental Remedial Investigation Work Plan, Health and Safety Plan).

As stated by USEPA in the Interim Final Guidance for RI/FS, the objective of conducting a remedial investigation, and subsequent feasibility study preparation, "is not the unobtainable goal of removing all uncertainty, but rather to gather information sufficient to support an informed risk management decision regarding which remedy appears to be most appropriate for a given site." The execution of the USEPA approved site specific plans, completion of all site sampling and laboratory analysis, and preparation of this RI Report, supported by the BERA and HHRA, demonstrate that the site has been appropriately characterized with regard to contaminants of concern and quantification of potential risks to human health and the environment.

The follow sections provide a summary of the hazardous substances or contaminants at and from the former ARMCO Hamilton Plant property, and the risk, if any, to human health and the environment posed by such substances and contaminants, based upon the completion of the RI.

The Supplemental RI work completed in 2008, combined with the prior RI conducted at the Site, has been determined to provide adequate delineation of the nature and extent of contamination at the Site as required by CERCLA.

## 8.1 Summary of findings

The following summarizes the findings of the RI, and conclusions reached regarding the need for further evaluation and/or CERCLA response action at the site.

- A sufficient number of samples were collected to delineate the nature and extent of contaminants from the Site and to perform a human health risk assessment and baseline ecological risk assessment.

- The Baseline HHRA conducted for the Site concluded that a limited number of areas are impacted by specific COCs such that calculated potential human health risk falls within or above the range specified by CERCLA ($1x10^{-4}$ to $1x10^{-6}$).

- In conformance to USEPA guidance, the Baseline HHRA included evaluation of a potential future residential use of the Site. The residential scenario was not carried through for purposes of remedial goal option development based on the consistent exceedance of residential risk parameters.

- Key constituents determined in the Baseline HHRA to exceed the calculated potential human health risk threshold range of $1x10^{-4}$ to $1x10^{-6}$ at the site based upon potential soil and groundwater pathways include total PCBs, a limited number of VOCs and SVOCs, and cyanide.

- Data collected and presented in a 2008 biocriteria study regarding the Site's impact to the Great Miami River concluded that the former ARMCO Hamilton plant site does not adversely affect the biological communities in adjacent and downstream portions of the Great Miami River.

- The BERA conducted for the Site concluded that no further ecological investigation of or response action for the AK Steel Former ARMCO Hamilton Plant facility, or the Great Miami River, is warranted for the Site.

- Deep groundwater sampling results indicate that no screening criteria are exceeded in the deep groundwater, thus demonstrating an absence of Site impact to the deeper aquifer.

- Shallow groundwater flows across the Site in a south-southwesterly direction on the northern parcel, a southerly direction on the southern parcel, and discharges to the Great Miami River. Deeper groundwater flows in a southwest direction.

- Groundwater sampling results indicate that the highest concentrations of COCs occur in shallow groundwater. Sampling results from intermediate wells indicate that VOCs and SVOCs exceed the screening criteria to a limited extent.

- AOC 13 shallow and intermediate aquifer groundwater concentrations were determined to be the most significant in both frequency of detections and number of constituents detected.

- Site specific geologic information, when correlated with the limited geologic and operational information currently available regarding the North Hamilton Well Field, indicates that the producing interval for the well field would have limited to no hydraulic connection to the sources of contamination at the Site. A USGS report (2005) indicates that a significant (50 feet) clay layer was identified in monitoring well 6D near the Hamilton North Wellfield. Correlation of Site well logs indicates that this significant clay layer and extends under the Great Miami River and across the site.

- A number of AOCs and Blocks were observed to have evidence of potential product in the subsurface. Table 8.1-1 provides a summary of all soil borings that have subsurface evidence of product, including presence of a sheen, soil staining, tar-like material, or coating on recovered soil/sand. The highest frequency of product evidence is found in AOC 13.

- AOC 9 and AOC 10 had several instances of visually identifiable product in the subsurface. The AOC 10 material appears to be related to the AOC 20 tar-like material and soil staining observations, which also likely correlates to tar material observed in the southern portion of AOC 22.

- In conformance to USEPA guidance, the Baseline HHRA included evaluation of a potential future residential use of the Site. The residential scenario was not carried through for purposes of remedial goal option development based on the consistent exceedance of residential risk parameters.

- Data quality objectives for the Site were achieved, and the site data are usable and reliable for decision-making purposes.

## 8.2 Recommendations

The RI has been completed in accordance with requirements of the Administrative Order on Consent, CERCLA and NCP regulatory requirements and in conformance to the USEPA approved RI Work Plans and USEPA guidance.

A number of areas have been determined to pose no unacceptable risk, to have COPCs that are consistent with background, and these areas are not anticipated to require any further evaluation under CERCLA. The majority of the AOCs and Blocks will be subject to further action under CERCLA based upon the findings of this RI. AK Steel recommends that the RI be approved such that a FS may be initiated for the Site. AK Steel further recommends that where feasible based upon the variety of COCs, frequency of detections, and other contributing factors, the number of potential remedial alternatives to be considered for many of the AOCs and Blocks be limited to a fairly small number. Limiting the potential remedial alternatives that must be evaluated in the Site FS will allow the CERCLA process to be streamlined and will more efficiently move the project toward the goal of mitigation of site risks to potential receptors through one or more CERCLA response actions.

The following sections provide AK Steel's recommendations for areas that do not merit further CERCLA evaluation, those areas anticipated to merit a narrowly focused set of remedial alternatives for consideration in a Site FS, and those that have more complex RI findings that are recommended both for FS evaluation of remedial alternatives and potential additional quantification of impacts in conjunction with preparation of a Site FS. AK Steel notes that the final approach for the RI, including a final decision of which remedial alternatives must be carried forward in a Site FS, will be determined by a re-evaluation of the Draft Technical Memorandum on the Development and Screening of Alternatives for the Former ARMCO Hamilton Site (ENSR, 2006). AK Steel and USEPA are anticipated to review the Draft Technical Memorandum, giving consideration to the findings of the RI, and revise and finalize the set of remedial alternatives to be considered in the FS following approval of this RI. Recommendations regarding the scope of alternatives to be considered for any AOC or Block as presented in this section may be changed based upon the AK Steel and USEPA evaluation of the Technical Memorandum.

### 8.2.1 No Further CERCLA Evaluation

Based upon outcome of the Baseline HHRA, the Site BERA and the data evaluation provided in this RI, AK Steel recommends that no further investigation or evaluation under CERCLA is required for the following AOCs at the Site. This RI has concluded that there is no threat to the public health, welfare, or the environment caused by the release or threatened release of hazardous substances, pollutants, or contaminants at or from the Site at the following locations:

- AOCs 3, 4, 5 and 6: Former storm water outfalls;
- AOCs 16 and 17: Off-site areas;
- AOC 19: Off-site Former Coke Oven Gas Pipeline;
- AOC 22 Soils;
- Great Miami River sediments; and,
- Great Miami River surface water.

### 8.2.2 Areas Recommended for Inclusion in CERCLA Feasibility Study

This section provides AK Steel's recommendations for various AOCs and Blocks with regard to the FS. As discussed above, the final set of remedial alternatives that are deemed appropriate will be established in separate documentation following this RI Report.

#### 8.2.2.1 Areas Recommended for Focused Feasibility Study

AOC 1, AOC 7, AOC 8, AOC 11, AOC 12, AOC 14, AOC 18 soil, AOC 21, Block A, Block E, Block F, and Block G all have constituents of concern that pose limited to no unacceptable risk based on the elimination of future residential land use from consideration at the Site. It is anticipated that institutional controls will be implemented to assure that future residential development does not occur at the site. Additionally, other institutional controls are anticipated to be evaluated and potentially implemented. Based upon the anticipated institutional controls and in consideration of the remedial goal options presented in the Baseline HHRA for the current soil scenario, on-site worker, AK Steel recommends that a focused evaluation of potential limited action remedies for these AOCs and Blocks should be considered. Data from the RI and its evaluation via the HHRA indicate that the need for an active remedy in these AOCs and Blocks is unlikely based upon CERCLA regulatory standards and USEPA guidance. Remedial alternatives for the Site will be further discussed prior to finalization of the *Technical Memorandum on the Development and Screening of Alternatives*, which currently is in draft form (ENSR, 2006), and subsequent to approval of this RI Report.

#### 8.2.2.2 AOC 2 Closed Landfill

Landfill perimeter borings SB1 to SB10 confirm that the lateral extent of the wastes placed in the landfill are within the boundaries of the perimeter fencing. Also, except for two borings around the perimeter of the landfill, silty clay with a low hydraulic conductivity [10(-6) to 10(-7) cm/sec] was encountered at the bottom of each of the perimeter borings, and also in two landfill characterizations borings. One landfill characterization boring (AOC2SB14) was terminated before natural sediments were encountered. Surface soil sampling results for AOC 2 indicate that no VOCs, PCBs and cyanide were detected above the screening values and only low concentrations of metals, SVOCs and dioxins that exceed the screening criteria are present in surface soils. Subsurface soil sampling results indicate that relatively low concentrations of metals and dioxins that exceed the screening criteria are present.

The highest concentrations of VOCs and SVOCs correspond to field observations of tar-like material and product staining in landfill borings AOC2SB14 and AOC2SB15. These observations correspond to areas of elevated magnetic gradient, higher ground conductivity response, and elevated magnetic susceptibility identified by the geophysical survey. The vertical extent of fill materials within the landfill was 16.4 ft bgs at AOC2SB13 and 14.4 ft bgs at AOC2SB15. The vertical extent of fill material was not defined in soil boring AOC2SB14 as fill materials were observed until the termination of the boring at 21.6 ft bgs. Separate phase product was not observed and there were no exceedances of MCLs or Tap Water PRGs in the landfill monitoring wells (MW-15S, -16S, -17S and -18S).

Groundwater monitoring wells MW-17S and MW-17M were installed and sampled downgradient of AOC 2. One MCL exceedance has been observed in MW-17M, which was installed and first sampled in 2008. Additional sampling should be conducted at this location to evaluate repeatability of the single MCL exceedance.

Recommendations

No further investigation of AOC 2 is required to assess the horizontal and vertical extent of chemicals of concern in soil from landfilled materials. Appropriate remedial alternatives for AOC 2 should be addressed within the Site FS. It is recommended that the evaluation of remedial alternatives for AOC 2 be focused and limited to a small number of alternatives that have been proven to be technically feasible and of reasonable cost for former landfills. Additional sampling is recommended to be conducted in MW-17M to evaluate repeatability of the single 2008 MCL exceedance.

### 8.2.2.3 AOC 9 - Former Fuel Oil USTs

Based on the geophysical results, no evidence of any buried USTs was documented in AOC 9. Surface soil sampling results for AOC 9 indicate that low concentrations of metals, SVOCs and dioxins, that exceed the screening criteria, are present in surface soils. No VOCs, PCBs or cyanide were detected in surface soils or the 2-10 feet sample interval above the screening criteria.

Subsurface soil sampling results indicate that relatively low concentrations of VOCs (benzene was detected in one sample above the screening criteria at a depth greater than 10 feet), SVOCs (primarily in the 2-10 feet sample interval, below 10 feet only naphthalene was detected above the SSL), metals (only in the 2-10 foot sample interval) and dioxins (one exceedance in the 2-10 foot sample interval) are present in subsurface soils. The concentration of naphthalene in AOC9SB2 at a depth greater than 10 feet exceeds the DAF 10 SSL. However, no phased product, staining or odor was observed in this boring. Field observations of phased product and staining in AOC9SB1 and AOC9SB4 near the water table correspond to areas of elevated magnetic gradient identified by the geophysical survey. However, low concentrations of VOCs and SVOCs were observed in the samples taken from these soil borings. Additional evidence of subsurface product was observed during installation of soil borings and monitoring wells in this area as described in Section 4. No NAPL has been observed in groundwater in nearby monitoring wells to date.

Recommendations

The 2008 Supplemental RI field work and resultant analytical data indicate that a limited subsurface area of petroleum product is present. Appropriate remedial alternatives for AOC 9 product and impacted soils should be evaluated in the Site FS.

### 8.2.2.4 AOC 10 – Former AST Area

Several soil borings in AOC 10 have indications of a tarry material in the subsurface. These observations appear to correlate with tarry material in the subsurface in nearby AOC 20 soil borings, as well as surface/shallow soils in a limited number of hand augered samples in AOC 22. The area of inferred impact is illustrated in Figure 4.30.2-1.

Recommendations

No further remedial investigation is recommended for AOC 10. Evaluation of potential remedial alternatives for the tarry material should be conducted via the Site CERCLA FS.

### 8.2.2.5 AOC 13 – Former by-products area

Numerous locations and depths have been identified as having impacted soils and groundwater within AOC 13. This section provides a summary of the findings of the RI for this AOC, and Figures 4.10.3-1 and 4.10.3-2 provide a focused evaluation of specific constituents identified in soil and groundwater within and immediately surrounding AOC-13.

Field observations of tar-like material were noted in several soil borings. Table 8.1-1 provides a summary of soil borings for which field observations of subsurface product evidence were recorded. A total of nine (9) separate soil boring locations and six (6) separate groundwater monitoring well locations within AOC 13 were identified as having field observations of subsurface product. Several of these locations had multiple depths of such field observations recorded on the field records (i.e., soil boring and monitoring well installation logs).

Surface soil sampling results for AOC 13 indicate that relatively low concentrations of metals and dioxins that exceed the screening criteria are present in surface soils. Higher concentrations of SVOCs and PCBs were detected within surface soils at AOC13. Elevated concentrations of SVOCs and PCBs were generally found at the same. Observations of staining, odors or phased product was not detected in surface soils at these locations, sampled material was similar to other soils observed in AOC13. Surface soils consisted of topsoil and fine grained fill materials with intermixed slag. The overall distribution of SVOC and PCB surface soil contamination appears to be concentrated in the southeastern and central portions of AOC 13.

Subsurface soil sampling results for soil from 2 to 10 ft bgs indicate that relatively low concentrations of dioxins that exceed the screening criteria are present in subsurface soils. Higher concentrations of VOCs, SVOCs, metals, and PCBs were detected in subsurface soils between 2 to 10 feet bgs. Elevated concentrations of contaminants were generally found at the same or proximal locations. Analytical results for all detections in soil above screening values for AOC 13 are provided as Tables 4.10-1 through 4.10-5. Constituents detected above the screening criteria in the southeastern and central portions of AOC13 are located in mixed slag and silt fill material that overlies native soils. The highest concentrations of detected constituents often correspond to field observations of odors, sheen, or other product indicators. Field observations of potential subsurface product are summarized in Table 8.1-1.

Subsurface soil sampling results for soil from greater than 10 ft bgs indicate that relatively low concentrations of metals that exceed the screening criteria are present in subsurface soils. Cyanide detections in soil were relatively low compared to groundwater detections. Higher concentrations of VOCs and SVOCs were detected in subsurface soils greater than 10 feet bgs. Concentrations of constituents that exceeded the screening are displayed on Figures 4.0.1-1 through 4.0.1-15, with focused display of select analytes illustrated in Figure 4.10.3-1 and 4.10.3-2.

High concentrations of VOCs observed in the northern portion of the Site were predominantly petroleum related compounds (BTEX). However, high concentrations of naphthalene were also observed in several related soil borings. Elevated concentrations of VOCs corresponded to observations of a separate phased product in AOC13SB6 from 18 to 21 ft bgs, petroleum odors in AOC13SB12 from 19 to 20 ft bgs, petroleum odors in AOC13SB13 from 16 to 17 ft bgs, petroleum odors in AOC13SB56 from 15 to 20 ft bgs, petroleum and tar-like odors, and a sheen in MW-9S

from 16 to 31 ft bgs. To the north of AOC 13, a sheen and odor in AOC15SB1 from 16 to 18 ft bgs and staining and petroleum odor in AOC15SB3 from 18 to 20 ft bgs were observed. Evidence of petroleum impacts were generally observed in these borings at depths located at the interface of coarse grained and fine grained materials, and in soils adjacent to the water table.

Elevated concentrations of VOCs and SVOCs were observed in the central portion of AOC13. Elevated concentrations corresponded to observations of a sheen in AOC13SB4 from 15 to 18 ft bgs, slag, wood and odors in AOC13SB37 from 6 ft to 26 ft bgs, staining and tar-like odors in MW-8S from 10 to 28 ft bgs, and petroleum and tar-like odors in MW-8M from 22 to 28 ft bgs. Other observations in the central area included a sheen and odors in AOC13SB39 from 10 to 16 ft bgs, and tar-like materials and a sheen in AOC13SB52 from 14 to 18 ft bgs. Evidence of petroleum impacts were generally observed in these borings at depths located at the interface of coarse grained and fine grained materials, and in soils adjacent to the water table.

Soil impacts observed in the southern portion of AOC 13 were predominantly VOCs. However, concentrations of VOCs observed in the southern portion of AOC 13 were generally lower than in the central and northern portions of AOC 13. Elevated concentrations of VOCs corresponded to observations of a petroleum odor, sheen and phased product in AOC13SB14 from 10 to 18 ft bgs. Other observations of soil impacts in the southern portion of AOC 13 included phased product in AOC13SB15 from 15 to 18 ft bgs.

Borings in the northern portion of AOC13 with high concentrations of BTEX also had relatively low concentrations of SVOCs and may be related to the former motor fuel storage area. Impacts observed in the central and southern portions of AOC13 may be related to the historical storage and processing of coke oven by-products.

Groundwater monitoring wells installed in and near AOC 13, and analytical results indicate impacts to shallow and intermediate depths of groundwater, including VOCs, SVOCs and cyanide. Supplemental RI data collected in 2008 are generally consistent with the prior RI findings for AOC 13, with soil and groundwater analytical results demonstrating complete delineation of this AOC. The Baseline HHRA provides a summary of groundwater risk drivers at the Site, and AOC 13 constituents detected in groundwater that are of specific concern include 1-methylnaphthalene, 2-methylnaphthalene, benzene, benzo(a)pyrene, naphthalene and cyanide. (Please refer to the Baseline HHRA for additional details regarding evaluation of calculated potential risk within AOC 13 media.) These groundwater detections are co-located with impacted soils containing VOCs and SVOCs as described above and in Section 4.10.

Recommendations

Several borings have been identified as having petroleum and tar-like material in collected subsurface soil samples. Soil borings have indicated presence of LNAPL at the former motor fuel tank area.

While indications of NAPL, tarry material, soil staining and odors have noted in field records of multiple soil borings within AOC 13, neither LNAPL nor DNAPL has been observed to date in any of the monitoring wells. The RI has delineated the nature and extent of groundwater and soil impacts within AOC 13. Key constituents in groundwater requiring evaluation in the FS, based upon the Baseline HHRA, include benzene, toluene, specific SVOCs and cyanide. For purposes of the RI, no further investigation is recommended for AOC 13 to delineate the nature and extent

of soil or groundwater contamination. Additional gauging and sampling of groundwater monitoring wells in and near AOC 13 is recommended to provide a more complete dataset for evaluation of groundwater impacts and for consideration in the Site FS.

AK Steel recommends that appropriate remedial alternatives be evaluated in a Site FS. Given the complexity of the historic use of this AOC, and the presence of multiple contaminants, it may be appropriate to evaluate a broader range of potential remedial alternatives for AOC 13 than is likely to be necessary for many of the other portions of the Site. Appropriate remedial alternatives to be considered will be finalized in a final, revised version of the *Draft Technical Memorandum on the Development and Screening of Alternatives* (ENSR, 2006).

#### 8.2.2.6 AOC 14 – Former Transformer and Compressor Area

Product/sheen and diesel odors were observed in the field at AOC14SB4 from 16 to 21 ft bgs. Subsurface petroleum impacts are limited, as these field observations were not observed in any adjacent borings and may be associated with AOC 13. Detections in AOC 14 soils exhibit similarities to AOC 13 detections.

Recommendations

AK Steel recommends that AOC 15 be further evaluated in the Site FS, and consideration be given to evaluating appropriate remedial alternatives for this AOC in conjunction with AOC 13 (see Section 8.2.2.4, above).

#### 8.2.2.7 AOC 15 – Former Transformer Area

Two soil borings at AOC 15 have evidence of subsurface product. Detections in AOC 15 soils exhibit similarities to AOC 13 detections.

Recommendations

AK Steel recommends that AOC 15 be further evaluated in the Site FS, and consideration be given to evaluating appropriate remedial alternatives for this AOC in conjunction with AOC 13 (see Section 8.2.2.4, above).

#### 8.2.2.8 AOC 20 – Remaining Areas on Southern Parcel

The majority of AOC 20 does not exhibit significant impacts based on a future industrial land use scenario. The southern-most portion of AOC 20 includes evidence of subsurface tar material. This material is discussed in detail elsewhere in this RI, and the detections are interpreted as being related to similar material identified in AOC 10 subsurface soils and at and near the ground surface in the southern portion of AOC 22.

Recommendations

AK Steel recommends evaluation of appropriate remedial alternatives for the tarry material be conducted in conjunction with AOCs 10 and 22 within a Site FS (also see discussion of AOC 10, above, Section 8.2.2.4). The remainder of AOC 22 is anticipated to be appropriate for focused feasibility study performance.

### 8.2.2.9 AOC 22 – Riparian Area

The presence of tarry material has been documented in AOC 22. The Baseline HHRA for the Site has established that AOC 22 soil concentrations of COPCs are consistent with background. Based on the findings of the Baseline HHRA and the BERA, continued CERCLA evaluation of the tarry material within AOC 22 is appropriate while AOC 22 soils have been demonstrated to be consistent with background concentrations when the tarry material is excluded from consideration.

Recommendations
AK Steel recommends limited additional quantification of the tarry material in the vicinity of identified Tar 3, 4 and 5 locations, and evaluation of appropriate remedial alternatives in a Site FS as discussed under AOC 10, above (see Section 8.2.2.4).

### 8.2.2.10 Block B Former Sinter Plant Production Area

Block B soil detections included exceedances of PAH, limited metals, PCBs and dioxin screening levels in surface soils. Cyanide concentrations exceeded the ESL but no PRGs were exceeded.

Subsurface soils had exceedances of screening levels for SVOCs and metals; no PCB screening exceedances were detected in subsurface samples.

No significant groundwater detections of VOCs or SVOCs have been observed in monitoring wells within, immediately adjacent to or downgradient of, Block B. These wells include: MW-1S, MW-1D, MW-2S, MW-2D, MW-4S, MW-4D, MW22S, MW-23S and MW-24S. Several SVOCs, with naphthalene being the most elevated at 120 ug/L, have been detected in MW-1S in December 2005 sampling and analysis. These detections were not repeated in the June 2008 sampling and analysis. MW-1S had a June 2008 cyanide detection of 8130 ug/L. One AOC 22 sample (AOC22RA18) was collected in 2008 to evaluate the potential for detected constituents of potential concern of storm water runoff or other releases from Block B into AOC 22. The sample results (further presented in the AOC 22 discussion of Section 4.30 of this report) indicate detections of constituents similar in nature to those detected in Block B, but generally at lower concentrations that those from Block B samples.

Recommendations

AK Steel recommends that appropriate remedial alternatives be evaluated for Block B in a Site FS.

### 8.2.2.11 Block C Former Blast Furnace Production Area

Surface and subsurface soils throughout Block C were observed to be relatively uniform, consisting of slag and fill materials intermixed with concrete and brick to depths ranging from approximately 10 to 25 ft bgs. Elevated SVOC concentrations are collocated with field observations of slag throughout, as well as coal-like material and a sulfur odor in BCSB8, phased product in BCSB7, and rust staining with a slight odor in BCSB12. Metals concentrations that exceed the screening criteria are also present throughout Block C within the subsurface soils but are particularly elevated within the central portion and along the eastern boundary. Elevated concentrations of metals are generally limited to a depth of approximately 10 ft bgs, with the

exception of selenium concentrations that exceeded the DAF within soil boring BCSB1 from 14 to 16 ft bgs.

The vertical extent of SVOC and metal impacts in most Block C borings do not appear to extend beyond a depth of approximately 10 ft bgs.

Recommendations

Block C impacts have been adequately characterized and are limited to relatively small number of constituents that decrease in concentration with depth. Very limited subsurface product indications were observed during the RI. Block C remedial alternatives should be evaluated within the context of a Site FS.

#### 8.2.2.12 Block D – Former railroad repair area

Surface soil sampling results for Block D indicate that low concentrations of PCBs and dioxins and concentrations of SVOCs and metals that exceed the screening criteria are present in surface soil fill materials.

Subsurface soil sampling results indicate that concentrations of SVOCs and metals that exceed the screening criteria are present in subsurface soils. The highest concentrations of SVOCs were detected in soil boring BDSB7. Field observations of include odor in BDSB1 from 16 to 18 ft bgs, phased product in BDSB2 from 16.5 to 18 ft bgs, a petroleum odor in BDSB3 from 16 to 18 ft bgs and phased product from 18 to 20 ft bgs, an odor in BDSB4 from 16.5 to 22 ft bgs, a petroleum odor in BDSB6 from 16.9 to 19 ft bgs, phased product and odor in BDSB7 from 16 to 18 ft bgs, an oily sheen and petroleum odor in BDSB8 from 16 to 18 ft bgs, and petroleum and phased product from 18 to 20 ft bgs. Concentrations of VOCs were detected below screening criteria in the subsurface samples collected from these borings, with the exception of BDSB7. MW-25S and MW-26S have had no to limited VOC and SVOC detections reported from groundwater sample analyses.

Recommendations

The analytical data from soil borings and monitoring wells demonstrate that the nature and extent of contamination at Block D have been fully delineated for purposes of the RI, and no further investigation is needed. AK Steel recommends that Block D be evaluated in the Site RI.

#### 8.2.2.13 Groundwater

Site and local geologic and hydrogeologic information indicate that transport of constituents in groundwater from the Site are anticipated to be inhibited significantly by the clay identified below the shallower, more significantly impacted groundwater. Site water level and relevant river gauging data also indicate that groundwater from the shallower Site sand and gravel discharge to the river; however, data from the GMR demonstrate that the Site has not negatively impacted the river. A review of site groundwater analytical data from wells MW-4M, MW-3D, MW-7M and MW-20M demonstrate an absence of significant detections of constituents of concern in the deeper sands being monitored by these wells (see Figure 3.4.2-2, Figure 4.29.1-1 and Figure 4.29.1-2).

Other than a very limited number of detections, analytical data from Northern Parcel groundwater samples do not indicate groundwater concerns in the Northern Parcel. Additional groundwater sampling is anticipated to evaluate any Northern Parcel groundwater monitoring wells with potential impacts from historic Site activities, for purposes of the FS.

Within the Southern Parcel, shallow groundwater sampling results, as well as some intermediate depth sampling results, indicate that the majority of groundwater detections that may pose potential risk to human health are concentrated in and near AOC 13. MW-1S, installed downgradient of Block B, has a reported detection of cyanide in excess of the MCL; MW-1D has no reported detections of any constituents of concern. Of significance for the Site, deep groundwater sampling results indicate that no exceedances of screening criteria have occurred in the deep groundwater. Specific information regarding constituents detected in Site groundwater is presented in Section 4.29 of this RI report. Groundwater impacts in the Southern Parcel generally are collocated with impacted soils, and AOC 13 is recommended to be carried forward to the Site FS for evaluation of appropriate remedial alternatives to address both soil and groundwater impacts. Appropriate remedial alternatives for impacted site groundwater should be further evaluated in conjunction with evaluation of remedial alternatives for impacted soils, as determined appropriate in the Site FS.

Based on the reasonably anticipated future use of the Site as industrial and excluding residential land use, AK Steel anticipates that institutional controls will be place upon the property, including a prohibition of use of groundwater. Implementation of institutional controls, and their ability to meet CERCLA criteria as part of any remedy for any AOC or Block, will be further evaluated through the FS.

Recommendations

The nature and extent of contaminants within groundwater have been delineated for the Site. AK Steel recommends that additional groundwater monitoring be conducted in conjunction with development of the Site FS following US EPA approval of this RI Report. AK Steel recommends that a reduced analyte list be utilized for any near-term site groundwater monitoring, based on the absence of detectable concentrations of PCBs and numerous other analytes. AK Steel further recommends that future Site groundwater monitoring requirements be evaluated through the FS and subsequent steps of the CERCLA process, with appropriate groundwater monitoring analyte lists and wells to be included in the monitoring network to be determined in conjunction with the selection of the CERCLA remedy(ies) for the Site.

#### 8.2.2.14 Surface water and sediments

The evaluation of surface water quality in the Great Miami River is complete. Surface water quality upstream of the Site and the former COG pipeline is consistent with downgradient surface water quality.

The evaluation of sediment quality in the Great Miami River is complete and, as with surface water quality conclusions, it has been determined that upgradient sediments have comparable or additionally elevated concentrations of evaluated constituents when compared to samples collected adjacent to and downgradient of the Site.

The 2007 biocriteria study, the 2008 Baseline HHRA and 2008 BERA provide evidence regarding upstream sediment sample analytical concentrations of inorganics and most organics (including PAHs) which are detected upstream of the former pipeline and the Site, and are potentially associated with the migration from upstream sources. The BERA concludes that no unacceptable ecological risk is posed by surface water and sediments. While the HHRA identifies potentially unacceptable risk to human health for surface water and sediments adjacent to the Site, data from the RI and presented within the HHRA clearly demonstrate that upstream concentrations of the COCs and resultant potential human health risks are consistent with, or elevated in comparison to, those calculated for the Site.

Recommendations

Based on the Site data and conclusions of the SLERA, biocriteria study, BERA and HHRA, no further CERCLA evaluation or consideration of surface water or sediments is appropriate.

## 8.3 Site Conceptual Model

A site conceptual model (SCM) was prepared for both the BERA and the HHRA. Both are provided in Appendix G, illustrating potential receptors and exposure pathways considered in the risk assessments of the Site.

Reasonably anticipated future use of the site is industrial. The HHRA demonstrates that a future residential scenario is not appropriate to consider for this site.

A qualitative conceptual model of site geology is provided in Section 5 of this RI.

## 8.4 Conclusions

The Site RI has been conducted in conformance with the standards of the Administrative Order on Consent, regulatory requirements of CERCLA and the NCP, and relevant USEPA and OEPA guidance. The Site has been appropriately characterized as to the nature and extent of Site-derived contaminants that may pose unacceptable risk to human health and the environment.

As presented in the Administrative Order on Consent and the Introduction of this RI Report, the objectives of the RI/FS are as follows:

- To determine the nature and extent of contamination and threat to the public health, welfare, or the environment, if any, caused by the release or threatened release of hazardous substances, pollutants, or contaminants at or from the Site, by conducting a remedial investigation, which includes human health and ecological risk assessment;
- To evaluate the nature and extent of hazardous substances, if any, at and from the AHP property and off-property areas where hazardous substances, if any, from the property have or may have come to be located, and also assess the risk from these hazardous substances (if any) on human health and the environment;
- To determine and evaluate alternatives for remedial action (if any) to prevent, mitigate, or otherwise respond to or remedy releases or threatened release of hazardous substances, pollutants, or contaminants at or from the Site or facility, by conducting a feasibility study; and,
- To evaluate alternatives for addressing the impact (if any) to human health and the environment from hazardous substances at the Site.

The first two objectives have been achieved through completion of the Site RI and submission of this Report, and the supporting Baseline HHRA and BERA.

AK Steel has provided recommendations regarding each AOC and Block at the Site with regard to conduct of an FS for the Site within this RI Report. The remaining objectives specified above (third and fourth bullets) will be achieved through the CERCLA FS process.
AK Steel recommends that USEPA approve this RI Report, to allow: 1) evaluation of remedial alternatives for the Site through a CERCLA FS, 2) subsequent additional steps toward determination of appropriate Site remedy(ies) and mitigation of risks to potential receptors based upon the findings of this RI and the supporting Site Baseline HHRA and BERA. Based upon the findings of the Baseline HHRA, BERA, this RI Report and other relevant Site documents, AK Steel notes that reasonably anticipated future use of the Site is continued industrial designation with appropriate institutional controls. It is anticipated that institutional controls will be evaluated via the Site CERCLA FS. Limitations to both soil and groundwater exposures via institutional controls are likely to be appropriate, and thus result in a recommendation that future discussions of remedial action objectives and remedial goals be based upon a CERCLA risk threshold of $1X10^{-4}$.

### 8.4.1 Data limitations

Environmental data collected under this RI have been determined to meet the objectives of the RI and are usable for decision making at the site. The environmental data used for decision making were evaluated as required by the Site QAPP, including completion of data validation (see Appendix E for project data validation reports). The environmental data were found to meet the standards of the QAPP, and the set of data compiled has been determined to provide both sufficient quantity and quality for the CERCLA decision making requirements of this RI. Data quality objectives for the project have been achieved.

### 8.4.2 Remedial Action Objectives and Remedial Goals

USEPA and AK Steel agreed in August 2008 project meetings that the Site remedial action objectives (RAOs) will be determined in follow up to the RI Report, based upon the findings and conclusions of this RI, including the HHRA and BERA results. It is anticipated that RAOs will be established following USEPA approval of the RI Report and prior to submission of a Draft Feasibility Study. Review and, as necessary, revision of the *Draft Technical Memorandum on the Development and Screening of Alternatives* (ENSR, 2006) will be completed to establish both the range of remedial alternatives that are appropriate to consider for impacted media at the site, and appropriate RAOs for the Site, following approval of this RI Report. Limitations to both soil and groundwater exposures via institutional controls are appropriate, and thus result in a recommendation that future discussions of remedial action objectives and remedial goals be based upon a CERCLA risk threshold of $1X10^{-4}$. Remedial goals will be established through the CERCLA process following approval of this RI Report and related to establishment of RAOs.

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**Table 4.28-2**
Soil Metals Analytical Results - Background
*AK Steel - Former Armco Hamilton Facility, New Miami, Ohio*

| | | | | | Sample Location | BGRR3 | | BGRR3 | | BGRR4 | | BGRR4 | | BGSLAG | | BGSLAG | | BGSLAG | | BGVNW6 | | BGVNW6 | | BGVNW7 | | BGVNW7 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Sample Top (ft below ground surface) | 0 | | 1 2 | | 0 | | 3 | | 0 | | 0 | | 0 | | 0 | | 3 | | 0 | | 2 2 | | |
| | | | | | Sample Bottom (ft below ground surface) | 1 | | 1 5 | | 1 | | 3 6 | | 2 | | 2 | | 2 | | 1' | | 3 3 | | 1 | | 2 5 | | |
| | | | | | Sample Date | 03/29/2006 | | 03/29/2006 | | 03/30/2006 | | 03/30/2006 | | 03/28/2006 | | 03/28/2006 | | 03/28/2006 | | 03/29/2006 | | 03/29/2006 | | 03/29/2006 | | 03/29/2006 | |
| Analyte | Industrial PRG (ug/kg) | ResPRG (ug/kg) | DAF 10 (ug/kg) | ESL (ug/kg) | | | | | | | | | | | | | | | | | | | | | | | |
| Aluminum | 1 00E+05 | 7.61E+04 | NE | NE | | 6390 | | 4560 | | 13400 | | 31600 | | 33700 | | 34400 | | 31300 | | 17400 | | 12300 | | 3910 | | 4730 | |
| Antimony | 4 09E+02 | 3 13E+01 | 3 00E+00 | 2 70E-01 | | <6 2 | UJ | <6 6 | UJ | <6 9 | U | <7 2 | U | <6 2 | UJ | <6 4 | UJ | <6 4 | UJ | <7 1 | UJ | <6 9 | UJ | <6 4 | UJ | <6 4 | UJ |
| Arsenic | 1 59E+00 | 3 90E-01 | 1 00E+01 | 1 80E+01 | | **14.8** | | **40.6** | | **7.5** | | **14.7** | | <1 | U | <1 1 | U | <1 1 | U | **10.1** | | **8.7** | | **6.2** | | **6.6** | |
| Barium | 6 66E+04 | 5 37E+03 | 8 20E+02 | 3 30E+02 | | 65 2 | J- | 50 4 | J- | 71 5 | | 108 | | **374** | J- | **390** | J- | **352** | J- | 128 | J- | 93.0 | J- | 29 2 | J- | 34'0 | J- |
| Beryllium | 1 94E+03 | 1 54E+02 | 3 00E+01 | 2 10E+01 | | 0 98 | | 0 64 | | <0 58 | U | <0 6 | U | 13 0 | | 11 8 | | 12 3 | | 1 1 | | 0 73 | | <0 53 | U | <0 53 | U |
| Cadmium | 4 51E+02 | 3 70E-01 | 4 00E+00 | 3 60E-01 | | <0 51 | U | <0 55 | U | <0 58 | U | <0 6 | U | <0 52 | U | <0 53 | U | <0 54 | U | <0 59 | U | <0 57 | U | <0 53 | U | **0.81** | |
| Chromium (total) | NE | 3 01E+01 | 2 00E+01 | 2 60E+01 | | 16 2 | | 11 9 | | 15 8 | | **32.9** | | 20 0 | | 17 5 | | **20.2** | | **22.0** | | 16 3 | | 10 1 | | **20.2** | |
| Cobalt | 1 92E+03 | 9 03E+02 | NE | 1 30E+01 | | <5 1 | U | <5 5 | U | 11 0 | | 11 4 | | <5 2 | U | <5 3 | U | <5 4 | U | 11.5 | | 9 0 | | <5 3 | U | <5 3 | U |
| Copper | 4 09E+04 | 3 13E+03 | NE | 2 80E+01 | | 16 5 | | **30.2** | | 12 4 | | 25 1 | | 3 1 | | <2 1 | U | <2 1 | U | 22 4 | | 16 5 | | 16 4 | | 24 5 | |
| Iron | 1 00E+05 | 2 35E+04 | NE | NE | | 17000 | J | 18300 | J | 17400 | | **34600** | | 7350 | J | 7770 | J | 6650 | J | **25300** | J | 20600 | J | 13600 | J | **26300** | J |
| Lead | 8 00E+02 | 4 00E+02 | NE | 1 10E+01 | | **81.7** | | **57.0** | | **13.0** | J | **16.9** | J | <5 2 | U | <5 3 | U | <5 4 | U | **2230** | | **20.8** | | **42.5** | | **285** | |
| Manganese | 1 95E+04 | 1 76E+03 | NE | 5 00E+02 | | **820** | | **611** | | **916** | | **768** | | **4640** | | **4520** | | **4560** | | **877** | | **873** | | **504** | | **676** | |
| Mercury | NE | NE | NE | 3 00E-01 | | | R | | R | <0 04 | U | 0 04 | | | R | | R | | R | 0 04 | J- | | R | 0 06 | J- | 0 19 | J- |
| Nickel | 2.04E+04 | 1 56E+03 | 7 00E+01 | 2 80E+01 | | 8 6 | | 9 7 | | <46 3 | U | <48 3 | U | <4 2 | U | <4 3 | U | <4 3 | U | 24 4 | | 20 1 | | 8 8 | | 11.1 | |
| Selenium | 5 11E+03 | 3 91E+02 | 3 00E+00 | 1 00E+00 | | <1 0 | U | **2.2** | | **2.3** | | **2.4** | | **2.4** | | **6.5** | | **1.9** | | **6.6** | | **3.0** | | <1 1 | U | **2.6** | |
| Silver | 5 11E+03 | 3 91E+02 | 2 00E+01 | 4 20E+00 | | <1 | U | <1 1 | U | <1 2 | U | <1 2 | U | <1 | U | <1 1 | U | <1 1 | U | <1 2 | U | <1 1 | U | <1 1 | U | <1 1 | U |
| Thallium | 6 75E+01 | 5 16E+00 | NE | 1 00E+00 | | <5 1 | U | <5 5 | U | <5 8 | U | <6 | U | <5 2 | U | <5 3 | U | <5 4 | U | <5 9 | U | <5 7 | U | <5 3 | U | <5 3 | U |
| Vanadium | 1 02E+03 | 7 82E+01 | 3 00E+03 | 7 80E+00 | | **12.2** | | **10.7** | | **30.9** | | 41 8 | J- | **59.3** | | **20.4** | | **18.9** | | **21.0** | | **35.0** | | **33.8** | | **11.4** | | **13.6** | |
| Zinc | 1 00E+05 | 2 35E+04 | 6 20E+03 | 5 00E+01 | | **109** | | **81.6** | | 41 8 | J- | **82.6** | J- | 5 0 | | 8 7 | | 6 8 | | **66.2** | | **57.4** | | **109** | | **446** | |

Notes
B - Indicates method blank contamination
J - The result is an estimated quantity, the associated numerical value is the approximate concentration of
J+ - The result is an estimated quantity, but the result may be biased high
J- - The result is an estimated quantity, but the result may be biased low
R - The data are unusable The sample result is rejected due to serious deficiencies The presence or absence of the analyte cannot be verified
U - The sample was analyzed for, but was not detected above the sample reporting limit
Values in **BOLD** indicate detected concentrations exceed one or more screening criteria
NE - Screening value not established
IndPRG - Industrial Soil PRG, U S EPA Region 9 PRG Table, October 2004
ResPRG - Lower of 1/10th non-carcinogenic or carcinogenic Residential Soil PRG, U S EPA Region 9 PRG Table, October 2004
DAF 10 - Ten times DAF 1, U S EPA Region 9 PRG Table, October 2004
ESL - Ecological Screening Level ESL hierarchy was 1) USEPA Ecological Soil Screening Values (value selected is the lower of the values derived for soil invertebrates, plants, birds, and mammals), 2) Oak Ridge National Laboratory screening benchmark for terrestrial plants (Efroymson, et al , 1997), values for earthworms are higher, and 3) USEPA Region 5 ESLs (USEPA 2003, Available at http //www epa gov/RCRIS-Region-5/ca/ESL pdf) Additional ESL information provided in the Ecological Screening Values Low Effects table

**Table 4.28-3**
Soil Dioxins Analytical Results - Background
*AK Steel - Former Armco Hamilton Facility, New Miami, Ohio*

| Sample Location: | | | | | BG-1 | | BGCOG1 | | BGCOG2 | | BGCOG3 | | BGPRK5 | | BGRR2 | | BGRR3 | | BGRR4 | | BGVNW6 | | BGVNW7 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Top (ft below ground surface): | | | | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | |
| Sample Bottom (ft below ground surface): | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | |
| Sample Date: | | | | | 03/28/2006 | | 03/30/2006 | | 03/30/2006 | | 03/30/2006 | | 03/29/2006 | | 03/29/2006 | | 03/29/2006 | | 03/30/2006 | | 03/29/2006 | | 03/29/2006 | |
| Analyte | Industrial PRG (ng/kg) | ResPRG (ng/kg) | DAF 10 (ng/kg) | ESL (ng/kg) | | | | | | | | | | | | | | | | | | | | |
| 1,2,3,4,6,7,8-HEPTACHLORODIBENZOFURAN | NE | NE | NE | 2.0E-01 | <0.61 | UB | **29.746** | B | **4.977** | B | **3.324** | | **37.473** | B | **83.908** | JB | **23.015** | JB | **4.727** | | <0 785 | UB | **11.378** | B |
| 1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN | NE | NE | NE | 2.0E-01 | <1.644 | UB | **78.166** | B | **33.216** | B | **10.572** | B | **96.701** | B | **100.321** | JB | **31.093** | B | **16.023** | JB | <2 259 | UB | **26.379** | B |
| 1,2,3,4,7,8,9-HEPTACHLORODIBENZOFURAN | NE | NE | NE | 2.0E-01 | <0.156 | UB | **7.73** | | **0.631** | JK | **0.392** | J | **6.374** | B | **7.013** | JB | **2.88** | JB | <0.086 | U | <0 172 | UB | <1 351 | UB |
| 1,2,3,4,7,8-HEXACHLORODIBENZOFURAN | NE | NE | NE | 2 0E-01 | **0.233** | J | **9.355** | | **0.552** | JK | **0.313** | JK | **3.471** | | **30.545** | J | **6.557** | J | **0.389** | J | <0.031 | U | **1.869** | J |
| 1,2,3,4,7,8-HEXACHLORODIBENZO-P-DIOXIN | NE | NE | NE | 2 0E-01 | 0.092 | J | **10.211** | | **0.695** | J | **0.227** | JK | **1.374** | J | **2.134** | J | **1.227** | J | **0.355** | J | 0 054 | J | **0.833** | J |
| 1,2,3,6,7,8-HEXACHLORODIBENZOFURAN | NE | NE | NE | 2 0E-01 | 0.133 | JK | **10.65** | B | <0 55 | UB | <0.341 | UB | **2.004** | J | **12.526** | J | **8.485** | J | <0 404 | UB | **0.321** | J | **1.33** | J |
| 1,2,3,6,7,8-HEXACHLORODIBENZO-P-DIOXIN | NE | NE | NE | 2.0E-01 | **0.591** | J | **12.022** | | **1.658** | J | **0.601** | J | **4.338** | | **6.711** | J | **4.303** | J | **0.677** | JK | **0.203** | J | **1.898** | J |
| 1,2,3,7,8,9-HEXACHLORODIBENZOFURAN | NE | NE | NE | 2.0E-01 | <0 023 | U | **7.515** | | <0 072 | U | <0.144 | U | <0 114 | U | **0.659** | J | <0.346 | U | <0 062 | U | 0.151 | J | **0.394** | J |
| 1,2,3,7,8,9-HEXACHLORODIBENZO-P-DIOXIN | NE | NE | NE | 2.0E-01 | **0.527** | J | **7.312** | | **1.799** | J | **0.692** | J | **3.839** | | **2.688** | J | **1.262** | J | **0.848** | JK | 0.136 | J | **1.204** | J |
| 1,2,3,7,8-PENTACHLORODIBENZO-P-DIOXIN | NE | NE | NE | 2.0E-01 | **0.377** | J | **52.4** | | **0.793** | J | <0 065 | U | **0.94** | J | **3.242** | J | **2.342** | J | <0 041 | U | <0.027 | U | **0.746** | J |
| 2,3,4,6,7,8-HEXACHLORODIBENZOFURAN | NE | NE | NE | NE | <0 192 | UB | 9.309 | | 0.69 | J | <0.125 | U | <2 378 | UB | 15.354 | JB | 33.418 | JB | 0.516 | J | <0 731 | UJB | <1 013 | UB |
| 2,3,4,7,8-PENTACHLORODIBENZOFURAN | NE | NE | NE | NE | 0.208 | J | 10.738 | | <0.05 | U | <0 053 | U | 0.905 | J | 18.88 | | 7.91 | | <0.036 | U | 0.238 | J | 1.087 | J |
| 2,3,7,8-TETRACHLORODIBENZOFURAN | NE | NE | NE | 3.9E+01 | <0 751 | U | 5.068 | | <0 135 | UJ | <1.681 | UJ | <0 418 | U | 18.015 | | 3.61 | | <0 078 | U | <0.024 | U | <0 86 | U |
| 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN | 1.6E+01 | 3.9E+00 | NE | 2.0E-01 | **0.299** | JK | **31.527** | | **0.567** | JK | **0.427** | J | **0.269** | JK | **0.856** | JK | **3.889** | | 0.192 | JK | <0 022 | U | **0.203** | JK |
| OCTACHLORODIBENZOFURAN | NE | NE | NE | NE | <0 921 | UB | 52.987 | B | 9.142 | B | <7 728 | U | 123.58 | B | 116.685 | B | 32.983 | B | 10.717 | B | <1.259 | UB | 24.004 | B |
| OCTACHLORODIBENZO-P-DIOXIN | NE | NE | NE | NE | 6 567 | B | 455.195 | B | 272.668 | B | 77.04 | B | 543.702 | B | 631.858 | B | 214.499 | JB | 121.978 | JB | 26.027 | B | 181.771 | B |
| Dioxin TEQ-HH | NE | 3 9E+00 | NE | 2 0E-01 | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | |

Notes:
B - Indicates method blank contamination.
J - The result is an estimated quantity; the associated numerical value is the approximate concentration of the analyte in the sample.
U - The sample was analyzed for, but was not detected above the sample reporting limit.
K - The result is considered to be "Estimated Maximum Potential Concentration" (EMPC)
Dioxin TEQ-HH is the sum of the individual dioxin congeners using the respective TEFs.
Values in **BOLD** indicate detected concentrations exceed one or more screening criteria
NE - Screening value not established.
IndPRG - Industrial Soil PRG, U.S. EPA Region 9 PRG Table, October 2004
ResPRG - Lower of 1/10th non-carcinogenic or carcinogenic Residential Soil PRG, U.S. EPA Region 9 PRG Table, October 2004
DAF 10 - Ten times DAF 1, U.S. EPA Region 9 PRG Table, October 2004
ESL - Ecological Screening Level. ESL hierarchy was 1) USEPA Ecological Soil Screening Values (value selected is the lower of the values derived for soil invertebrates, plants, birds, and mammals); 2) Oak Ridge National Laboratory screening benchmark for terrestrial plants (Efroymson, et al., 1997); values for earthworms are higher; and 3) USEPA Region 5 ESLs (USEPA 2003; Available at http://www.epa.gov/RCRIS-Region-5/ca/ESL.pdf). Additional ESL information provided in the Ecological Screening Values. Low Effects table.

**Table 4.28-1**

Soil Semi-Volatile Organic Compound Analytical Results - Background

*AK Steel - Former Armco Hamilton Facility, New Miami, Ohio*

| | | | | | Sample Location: | BG-1 | BGCOG1 | BGCOG2 | BGCOG3 | BGPRK5 | BGRR2 | BGRR2 | BGRR3 | BGRR4 | BGVNW6 | BGVNW7 | BGVNW7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Sample Top (ft below ground surface): | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 2.2 |
| | | | | | Sample Bottom (ft below ground surface): | 1 | 1 | 1 | 1 | 1 | 1 | 3.5 | 1 | 1 | 1 | 1 | 2.5 |
| | | | | | Sample Date | 03/28/2006 | 03/30/2006 | 03/30/2006 | 03/30/2006 | 03/29/2006 | 03/29/2006 | 03/29/2006 | 03/29/2006 | 03/30/2006 | 03/29/2006 | 03/29/2006 | 03/29/2006 |
| Analyte | Industrial PRG (ug/kg) | ResPRG (ug/kg) | DAF 10 (ug/kg) | ESL (ug/kg) | | | | | | | | | | | | | |
| Acenaphthene | 2.9E+07 | 3.7E+06 | 2.9E+05 | 2.0E+04 | <390 U | <740 U | <430 U | <380 U | <380 U | 300 J | **42000** J | 180 J | <390 U | 580 J | <1100 U | <1100 U |
| Acenaphthylene | NE | 3.7E+06 | NE | 6.8E+05 | <390 U | 380 J | 46 J | <380 U | 52 J | 1700 J | 410000 | 360 J | <390 U | 350 J | 280 J | 320 J |
| Anthracene | 1.0E+08 | 2.2E+07 | 5.9E+06 | 1.5E+06 | <390 U | 320 J | <430 U | <380 U | <380 U | 3800 | 470000 | 550 J | 46 J | 2300 J | 150 J | 310 J |
| Benzo(a)anthracene | 2.1E+03 | 6.2E+02 | 8.0E+02 | 5.2E+03 | <390 U | **880** | 200 J | 52 J | 170 J | **8600** | **500000** | **2400** | 210 J | **3600** | **770** J | **1100** J |
| Benzo(a)pyrene | 2.1E+02 | 6.2E+01 | 4.0E+03 | 1.5E+03 | <390 U | **880** | **240** J | 53 J | **190** J | **7200** | **350000** | **2500** | **220** J | **2600** | **780** J | **1100** |
| Benzo(b)fluoranthene | 2.1E+03 | 6.2E+02 | 2.0E+03 | 6.0E+04 | <390 U | **1100** | 220 J | 55 J | 170 J | **6300** | **240000** | **2300** | 230 J | **1700** J | **730** J | **1200** |
| Benzo(g,h,i)perylene | NE | 2.3E+06 | NE | 1.2E+05 | <390 U | 880 | 160 J | 40 J | 140 J | 3600 | **160000** | 1700 | 170 J | 1400 J | 690 J | 950 J |
| Benzo(k)fluoranthene | 1.3E+03 | 3.8E+02 | 2.0E+04 | 1.5E+05 | <390 U | **900** | 200 J | 53 J | 160 J | **6500** | **320000** | **2300** | 220 J | **2300** J | **680** J | **1000** J |
| Chrysene | 2.1E+05 | 6.2E+04 | 8.0E+04 | 4.7E+03 | <390 U | 1100 | 300 J | 70 J | 190 J | **7500** | **390000** | 2700 | 250 J | 3200 | 790 J | 1200 |
| Dibenz(a,h)anthracene | 2.1E+02 | 6.2E+01 | 8.0E+02 | 1.8E+04 | <390 U | **220** J | <430 U | <380 U | 44 J | **1300** J | **56000** J | **480** J | 58 J | **410** J | **190** J | **250** J |
| Fluoranthene | 2.2E+07 | 2.3E+06 | 2.1E+06 | 1.2E+05 | <390 U | 1700 | 510 | 130 J | 360 J | 16000 | **1100000** | 5300 | 500 J | 6700 | 1600 | 2300 |
| Fluorene | 2.6E+07 | 2.7E+06 | 2.8E+05 | 1.2E+05 | <390 U | 98 J | <430 U | <380 U | <380 U | 1200 J | **320000** | 160 J | <390 U | 1100 J | <1100 U | 160 J |
| Indeno(1,2,3-cd)pyrene | 2.1E+03 | 6.2E+02 | 7.0E+03 | 1.1E+05 | <390 U | **730** J | 140 J | <380 U | 130 J | **3700** | **170000** | **1600** | 160 J | **1100** J | 540 J | **820** J |
| Naphthalene | 1.9E+05 | 5.6E+04 | 4.0E+04 | 9.9E+01 | <390 U | **990** | **250** J | <380 U | <380 U | **1500** J | **220000** | **110** J | 56 J | <2300 U | <1100 U | **320** J |
| Phenanthrene | NE | 2.2E+07 | NE | 4.6E+04 | <390 U | 1600 | 430 | 83 J | 150 J | 11000 | **1600000** | 2700 | 290 J | 6100 | 610 J | 1700 |
| Pyrene | 2.9E+07 | 2.3E+06 | 2.1E+06 | 7.9E+04 | <390 U | 1400 | 450 | 120 J | 300 J | 12000 | **910000** | 4400 | 460 J | 5600 | 1400 | 2100 |

Notes:

B - Indicates method blank contamination.

J - The result is an estimated quantity; the associated numerical value is the approximate concentration of the analyte in the sample.

R - The data are unusable. The sample result is rejected due to serious deficiencies. The presence or absence of the analyte cannot be verified.

U - The sample was analyzed for, but was not detected above the sample reporting limit.

Values in **BOLD** indicate detected concentrations exceed one or more screening criteria.

NE - Screening value not established.

IndPRG - Industrial Soil PRG, U.S. EPA Region 9 PRG Table, October 2004

ResPRG - Lower of 1/10th non-carcinogenic or carcinogenic Residential Soil PRG, U.S. EPA Region 9 PRG Table, October 2004

DAF 10 - Ten times DAF 1, U.S. EPA Region 9 PRG Table, October 2004

ESL - Ecological Screening Level. ESL hierarchy was 1) USEPA Ecological Soil Screening Values (value selected is the lower of the values derived for soil invertebrates, plants, birds, and mammals); 2) Oak Ridge National Laboratory screening benchmark for terrestrial plants (Efroymson, et al., 1997); values for earthworms are higher; and 3) USEPA Region 5 ESLs (USEPA 2003; Available at http://www.epa.gov/RCRIS-Region-5/ca/ESL.pdf). Additional ESL information provided in the Ecological Screening Values. Low Effects table.

**Table 4.28-2**
Soil Metals Analytical Results - Background
*AK Steel - Former Armco Hamilton Facility, New Miami, Ohio*

| | | | | | Sample Location | BG-1 | | BG-1 | | BGCOG1 | | BGCOG1 | | BGCOG2 | | BGCOG2 | | BGCOG3 | | BGCOG3 | | BGPRK5 | | BGPRK5 | | BGRR2 | | BGRR2 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Sample Top (ft below ground surface) | 0 | | 3 | | 0 | | 3 | | 0 | | 3 | | 0 | | 3 | | 0 | | 3 | | 0 | | 3 | |
| | | | | | Sample Bottom (ft below ground surface) | 1 | | 3 7 | | 1 | | 3 5 | | 1 | | 3 5 | | 1 | | 3 5 | | 1 | | 3 5 | | 1 | | 3 5 | |
| | | | | | Sample Date | 03/28/2006 | | 03/28/2006 | | 03/30/2006 | | 03/30/2006 | | 03/30/2006 | | 03/30/2006 | | 03/30/2006 | | 03/30/2006 | | 03/29/2006 | | 03/29/2006 | | 03/29/2006 | | 03/29/2006 | |
| Analyte | Industrial PRG (ug/kg) | ResPRG (ug/kg) | DAF 10 (ug/kg) | ESL (ug/kg) | | | | | | | | | | | | | | | | | | | | | | | | | |
| Aluminum | 1 00E+05 | 7 61E+04 | NE | NE | 12700 | | | 12100 | | 4390 | | 15000 | | 8790 | | 16900 | | 7350 | | 12300 | | 7260 | | 4860 | | 7620 | | 3960 | |
| Antimony | 4 09E+02 | 3 13E+01 | 3 00E+00 | 2 70E-01 | <7 0 | U | J | <7 1 | UJ | <6 6 | U | <7 2 | U | <7 5 | U | <6 7 | U | <6 9 | U | <7 5 | U | <6 6 | UJ | <6 4 | UJ | <7 4 | UJ | <7 3 | UJ |
| Arsenic | 1 59E+00 | 3 90E-01 | 1 00E+01 | 1 80E+01 | **12.7** | | | **7.3** | | **68.5** | | **9.4** | | **10.9** | | **10.4** | | **8.3** | | **7.8** | | **5.9** | | **5.3** | | **31.8** | | **35.4** | |
| Barium | 6 66E+04 | 5 37E+03 | 8 20E+02 | 3 30E+02 | 86 3 | | J- | 98 5 | J- | 75 6 | | 119 | | 126 | | 101 | | 74 8 | | 93 0 | | 54 6 | J- | 34 4 | | 107 | J- | 91 0 | J- |
| Beryllium | 1 94E+03 | 1 54E+02 | 3 00E+01 | 2 10E+01 | 0 77 | | | 0 70 | | <0 55 | U | <0 6 | U | <0 63 | U | <0 56 | U | <0.57 | U | <0 62 | U | <0 55 | U | <0 53 | U | 1 1 | | <0 61 | U |
| Cadmium | 4 51E+02 | 3 70E+01 | 4 00E+00 | 3 60E-01 | <0 58 | U | | <0 59 | U | <0 55 | U | <0 6 | U | <0 63 | U | <0 56 | U | <0 57 | U | <0 62 | U | <0 55 | U | <0'53 | U | **3.0** | | <0 61 | U |
| Chromium (total) | NE | 3 01E+01 | 2 00E+01 | 2 60E+01 | 18 0 | | | 15 7 | | 11 9 | | 16 4 | | 13 5 | | 18 9 | | 11 3 | | 16 0 | | 13 1 | | 8 8 | | **50.7** | | 13 1 | |
| Cobalt | 1 92E+03 | 9 03E+02 | NE | 1 30E+01 | 7.9 | | | 8 1 | | 5 8 | | **14.1** | | 9 2 | | 9 4 | | 10 0 | | 10 6 | | <5 5 | U | <5 3 | U | 9 5 | | <6 1 | U |
| Copper | 4 09E+04 | 3 13E+03 | NE | 2 80E+01 | 16 8 | | | 15 7 | | **122** | | 13 3 | | 23 8 | | 16 6 | | 10 9 | | 15 3 | | 14 3 | | 8 3 | | **85.7** | | **29.8** | |
| Iron | 1 00E+05 | 2 35E+04 | NE | NE | 20200 | | J | 19800 | J | 21800 | | 19000 | | 16900 | | 21200 | | 14600 | | 18800 | | 14300 | J | 10500 | | **132000** | J | **33300** | J |
| Lead | 8 00E+02 | 4 00E+02 | NE | 1 10E+01 | **16.2** | | | **11.8** | | **93.6** | J | **16.7** | J | **30.0** | J | **11.9** | J | **15.0** | J | **13.0** | J | **23.9** | | 9 7 | | **227** | | **51.5** | |
| Manganese | 1 95E+04 | 1 76E+03 | NE | 5 00E+02 | **649** | | | **601** | | 278 | | **999** | | **857** | | **504** | | **930** | | **771** | | 485 | | 415 | | **2270** | | 464 | |
| Mercury | NE | NE | NE | 3 00E-01 | | | R | | R | **0.40** | | <0 04 | U | 0 08 | | <0 04 | U | <0 04 | U | <0 04 | U | 0 04 | J- | | R | 0 23 | J- | 0'1 | J- |
| Nickel | 2 04E+04 | 1.56E+03 | 7 00E+01 | 2 80E+01 | 18 2 | | | 19 2 | | 12 7 | | 15 6 | | 14 3 | | 18 6 | | 13 8 | | 16 4 | | 11 6 | | 8 2 | | **30.8** | | 12 3 | |
| Selenium | 5 11E+03 | 3 91E+02 | 3 00E+00 | 1 00E+00 | **4.8** | | | **5.3** | | **3.2** | | **2.4** | | **2.4** | | **2.0** | | **2.4** | | **2.4** | | **2.0** | | <1 1 | U | **14.8** | | **6.0** | |
| Silver | 5 11E+03 | 3 91E+02 | 2 00E+01 | 4 20E+00 | <1 2 | U | | <1 2 | U | <1 1 | U | <1 2 | U | <1 3 | U | <1 1 | U | <1 1 | U | <1 2 | U | <1 1 | U | <1 1 | U | <1 2 | U | <1 2 | U |
| Thallium | 6 75E+01 | 5 16E+00 | NE | 1'00E+00 | <5 8 | U | | <5 9 | U | <5 5 | U | <6 | U | <6 3 | U | <5 6 | U | <5 7 | U | <6 2 | U | <5 5 | U | <5 3 | U | <6 2 | U | <6 1 | U |
| Vanadium | 1 02E+03 | 7 82E+01 | 3 00E+03 | 7 80E+00 | **30.8** | | | **28.4** | | **17.5** | | **35.1** | | **24.2** | | **37.0** | | **21.2** | | **27.1** | | **17.4** | | **12.2** | | **26.7** | | **11.7** | |
| Zinc | 1 00E+05 | 2 35E+04 | 6 20E+03 | 5 00E+01 | **64.6** | | | **66.4** | | **107** | J- | 49 4 | J- | **75.3** | J- | **55.8** | J- | 37 3 | J- | **50.8** | J- | **196** | | **75.0** | | **903** | | **156** | |